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HARRY AND LUCY.

BY

MARIA EDGEWORTH.

COMPLETE IN THREE VOLUMES.

VOL. III.

The business of Education, in respect of knowledge, is not, as I think, to perfect a learner in all or any one of the sciences ; but to give his mind that disposition and those habits that may enable him to attain any part of knowledge he shall stand in need of in the future course of his life.

LOCKE.

THE THIRD EDITION, REVISED AND CORRECTED.

LONDON :

BALDWIN AND CRADOCK ;

AND

GEORGE ROUTLEDGE, RYDER'S COURT,
LEICESTER SQUARE. ·

1840.



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HARRY AND LUCY.

PRINCE RUPERT.

IN returning to the castle, they passed through a wild part of the deer-park, where there was a profusion of fine primroses. Harry amused himself by sticking some of them into the ribbon round the crown of Lucy's straw hat.

As they walked on, and came near to the place where the spotted deer were browsing, the deer looked up, and stood gazing upon them, with their large dark protuberant glassy eyes, necks erect, and branching antlers thrown backwards. After an instant standing at gaze, the foremost of the herd turned short about, and made off, and all the others followed him at full trot. Lucy was sorry for this, and fancied that they had been frightened by her chaplet of primroses, which she now took from her hat: but Lady Digby assured her that the chaplet was not to blame; that deer are such timid creatures, that they are startled

by the least noise, and never suffer any strangers to approach them ; but, like almost all other animals, they can be tamed by kind treatment. Sir Rupert told Lucy that he had seen a tame deer belonging to a regiment so docile, that he would let a little boy ride upon him, and even permit the soldiers to amuse themselves by sticking their knapsacks upon his antlers.

Harry and Lucy, who ran on before the rest of the party, presently came to a sort of fence which divided the park ; it was made of a single cord, stretched between posts, with feathers stuck across the cord at intervals. Harry and Lucy waited till Sir Rupert came up, and then asked what this was for. Sir Rupert told them that it was an experiment of his gamekeeper's, who had assured him that this sort of fence was the best that could be used to prevent deer from straying beyond any prescribed boundary. They are frightened by the fluttering of the feathers, and never attempt to leap or pass this fence. " This may be true, or it may be false," said Sir Rupert : " experiment must determine. I never allow myself to decide, without trial, against what are called vulgar errors."

Nothing further, worthy of note or comment, happened during this walk.

They drank tea in a part of the castle which Harry and Lucy had not yet seen ; in a long

gallery, which, as Sir Rupert told them, had been much longer, magnificently, but uncomfortably long, so that it could not easily be warmed by day, or lighted by night; therefore he had taken off a room for himself at one end, and at the other end had made a conservatory for Lady Digby. The middle part was now fitted up with book-cases, and was not too long to be easily and well warmed in winter. Over the chimney-piece there was a picture of a man in armour; whose countenance, as Harry observed, was more thoughtful than warlike, more like a philosopher than a soldier.

After tea Harry returned to the picture, and asked if it was a portrait, and of whom? Lady Digby told him that it was a portrait of an ingenious and learned man, who was connected with their ancestors, and from veneration for whom the name of Rupert was given to Sir Rupert Digby. This was the portrait of Prince Rupert.

“Prince Rupert!” exclaimed Harry, in a tone of delight and admiration.

“Prince Rupert!” cried Lucy. “Oh! let me look at him, if he is your Prince Rupert, Harry, who discovered the wonderful drops.”

“He is,” said Lady Digby; “did you ever see those drops?”

“Never,” said Lucy; “I have only heard of

them from Harry; he described them to me: he told me that if I had one of them in my hand, and were to hold it fast, while he were to break a bit off the slender glass neck, the drop would directly explode, with a loud snap; and he said that I should feel an odd sort of tingling in my hand, and find that the glass had broken into thousands of pieces. Prince Rupert," continued Lucy, looking up at the picture, "I am glad to see you, and I should like very much to see and hear one of your wonderful drops."

Sir Rupert Digby told her that he believed he had some in his laboratory; and that, if he could find them next morning, he would show one to her; but it was now too late in the evening; he did not like to go into the laboratory by candle-light, as he had there various combustibles, of which it was necessary to be careful.

This evening he produced, for Harry's and Lucy's amusement, a portfolio of prints and drawings; among these he showed them an engraving of his illustrious namesake, Prince Rupert. Harry looked closely at the print—so did Lucy; then, smiling, she said—

"I know, Harry, what you are thinking of. It is—and it is quite just."

"It is," replied Harry, nodding, "and it is quite just."

“It is,” echoed Sir Rupert, “and it is quite just. I know,” added he, “what you are both thinking of.”

“I have no doubt that whatever is, is right,” said Lady Digby; “but it is always a pleasure to have it illustrated: therefore pray explain.”

“And, though I dare say you all understand each other,” said Harry’s father, “let us make sure of it. Remember the two Dervises, in the Persian Tale, who held up their fingers, and made signs and nodded, and pretended to understand one another, but were found out at last each to mean different things, or to mean nothing at all. Pray explain, Lucy.”

“I was thinking,” said she, “of what Harry told me a great while ago, that Prince Rupert invented this kind of engraving: I forget the name of it.”

“Mezzotinto,” said Harry.

“And,” continued Lucy, “when I looked close at the print, and said, *it is*, and *it is quite just*, I meant that it was mezzotinto; and it was quite just that Prince Rupert’s own portrait should be preserved in the sort of engraving which he invented.”

“Exactly what I meant,” said Harry.

“And what I thought you meant,” said Sir Rupert.

“You were not like the cheating Dervises, it is

clear," said Lady Digby. "But now I wish that you, Harry, would describe to me how this sort of engraving is done."

Harry took up a knife, which lay on the library table, at one end of which was a very fine file. He showed the lines upon the file, which were cut in two directions, obliquely crossing each other. "I believe," said he, "that the copper-plate on which a mezzotinto engraving is to be made, is, in the first place, cut all over into fine lines and furrows, like this file; then if the whole plate were inked over, with the ink used by engravers, and pressed off on paper, there would be only a dark engraving of crossing lines and dots, such as these which we see in this mezzotinto engraving. But, when we want to have a design engraved, the outline is drawn upon the plate, after the lines have been cut. Wherever the lights are to be, the engraver scrapes away the ridges; and for the strongest lights, where the paper is to be left white, he scrapes away quite to the bottom of the furrows, and polishes the plate smooth in that part. For all the lesser lights and shades he scrapes away in proportion, or leaves the ridges as deep and strong as they are wanted. The plate being then inked all over, and pressed down upon paper, and rolled off, the impression of the engraving is made, and in lines and dots like this or any other mezzotinto print."

Lady Digby thanked Harry, who had worked hard to get through this explanation ; colouring redder and redder, as he went on, till it was happily completed. Sir Rupert wrote something at the bottom of the print of his namesake, and then gave it to Harry.

Lucy read with joy these words :—

“ For a young friend, whose early admiration of excellence gives the best promise that in time he will himself excel.”

Lady Digby found a sheet of silver paper, and a roller, on which she rolled the print ; which, by-the-bye, some connoisseurs will say is the worst thing she could have done for the engraving. The most experienced assure us, however, that if the print, or drawing, is rolled with the back towards the roller, all will be safe.

“ Harry, before you go to something else,” said Sir Rupert, “ can you tell me by what accident or by what observation, Prince Rupert was led to the invention of mezzotinto engraving ?”

“ I could,” said Harry ; “ but what use, sir, when you know it already—much better than I do ?”

Harry said this rather in a gruff tone, being seized at the moment with a twinge of his old complaint of bashfulness. When he had thought that Lady Digby really and truly, for her own sake, wanted to have the thing explained, he had

exerted himself to get through the explanation; but now he thought just what he said, that it was of no use—except, perhaps, to *show him off*, which was what he detested. His father, however, put the matter in a new light to him, by saying,

“It may be of no use to Sir Rupert Digby that you should explain this to him, Harry; but it will be of use to yourself; for you have often found that you are not sure of knowing any thing clearly till you have tried to explain it: and, above all, it is necessary for a man to be able to conquer the sort of reluctance to speak, when called upon, which you feel at this moment.”

Harry made a desperate effort, and went on directly, not in the best words possible: but any were better than none; and he cleared up, and had more power of choice as he went on.

“I believe—I am not sure—I think, that one day Prince Rupert happened to see a soldier cleaning a rusty fusil, as they called it—that is, a gun—and, I suppose, but I do not know exactly how it was—but I suppose Prince Rupert saw the impression of the rusty gun left upon some piece of wood or paper; and he observed, that where the rust had been scraped away most, or least, the impression was the strongest, or the most faint; and the Prince, being an ingenious man, thought of applying this to engraving. He thought, that if the whole plate for any engraving

were *roughed* over, as the gun was with rust, and then scraped away clean, more or less, for the lights, in the way I before described, this might do; so he tried, and it succeeded. He was the first who ever made a mezzotinto engraving with his own hand: I remember that, for I thought how happy he must have been when it succeeded."

"Oh, I recollect," cried Lucy, "another interesting thing, Harry, which you told me, about the Prince having suspected his servant of stealing his tool, and finding he was mistaken; and his generosity, you know, about giving him—I forget what—at last."

Harry explained for Lucy, that an engraver, who lived at the same time, discovered, by his own ingenuity, the Prince's method of engraving, which had been kept a great secret. This engraver made some mezzotinto engravings, and Prince Rupert happening to see one of them, suspected at first that his own servant had secretly taken away his tool for preparing the copper, and had shown or lent it to the engraver: but the engraver convinced Prince Rupert that his suspicion was unjust, for he showed him the tool which he had used: it was a *file*; but the Prince's was a *roller*, with small grooves. When the Prince was quite convinced that there had been no unfair play, and that his servant had not betrayed him, he generously made him a present of his roller.

Some of the engravings in the portfolio were coloured. There was a set of prints of the odd and pretty dresses of the peasants belonging to different cantons of Switzerland. While Lucy amused herself by looking at their little straw hats, stuck on one side of the head, and their long plaited tails, and their horse-hair butterfly-wing caps, Harry was equally happy looking at some engravings, which Sir Rupert was showing his father, of Gothic cathedrals. Every now and then Sir Rupert kindly turned to Harry, and stopped in what he was saying, to tell him of the names and use of the different parts of the buildings, and to explain to him, gradually, a little more and a little more, about the different styles of architecture which have prevailed in England at different periods.

Bed-time came too soon.

"As it always does," said Lucy, "when we are busy and happy."

Lady Digby put into her hand a little lamp, which was so pretty that it was enough to comfort any body of her age for being obliged to go to bed. The little glow-worm flame burned bright within a globe of glass so sheltered, that there was no danger of its being blown out; and the oil in its invisible receptacle was secured from dropping on clothes, carpet, or floor, even in the hands of the careless, who run, or of the sleepy, who slope their

candlesticks as they walk. Whisking it over her head, and flourishing it as she went, Lucy proved the value of these properties; and Harry only wished that it was a gas instead of an oil lamp. He hoped to see a portable gas lamp some time or other.

RUPERT'S DROPS.

AFTER breakfast, when letters and newspapers had been read and discussed, Sir Rupert recollected his promise to Harry and Lucy of showing them some of Prince Rupert's drops; and he saw, in their eyes, their eagerness for its accomplishment.

"Follow me, then," said he, "to the laboratory."

They followed him down stairs, through the hall, into the court, when, turning to the right hand, he stopped at the iron door.

"So it is only the door into the laboratory, after all!" cried Lucy, as he opened it. "You were right, Harry, to advise me not to raise my expectations, or to fancy some grand mystery: how disappointed I should have been! Only the door into the laboratory! And why was it made of iron? and why, sir, did you bid us not open it?"

Sir Rupert told her that this door was made before his time, when the room was used, perhaps, as a place of safety for papers, or money; and an iron door was the strongest for defence, and the best security in case of fire. He had desired Harry and Lucy not to open it, because he

kept in this laboratory some things which might be dangerous, if incautiously meddled with.

As she entered the laboratory, Lucy was very cautious not to touch any thing, and looked with reverence around her.

Sir Rupert produced one of the drops which they came to see. It was a slender piece of solid greenish glass, about the thickness of a currant, but shaped somewhat like a pear, with a long delicate stalk. Giving it to Lucy, he bid her shut her hand over it, and hold it fast; he then broke off the end of the little glass stalk, and instantly Lucy heard a snapping noise, and felt a smart twinge, as she described it. On opening her hand, which she did with a start the instant she heard the crack, countless pieces of glass, fine as sand, fell to the ground: this was all that remained of the lump, which had thus shivered to bits. Lucy looked astonished at what had happened, and for a moment remained in silent wonder. Harry asked to have it explained.

“First I will tell you how these drops are made,” said his father; “by letting hot melted glass, such as you saw at the glass-house, fall into cold water.”

“I recollect, papa,” said Lucy, “that when we were at the glass-house I saw a man dropping melted glass into a bucket of cold water; but I did not know what he was doing, and I little

thought those were the wonderful Rupert's drops. What else is done to them afterwards, papa?"

"Nothing, my dear. After they have been suddenly cooled, in this manner, by falling into cold water, each solid drop, or bulb, remains in the tadpole shape you see, each with his slender tail; and they have the property, which you have just now seen, of bursting and shivering to pieces, with a slight explosion, when that tail is suddenly broken."

"*Suddenly broken*," repeated Sir Rupert, "as your father accurately says, Harry. The tail may be ground off gently without bursting the drop. A friend of mine has tried this experiment,"* continued Sir Rupert. "He told me, that he had ground the bulb of one of these drops into the shape of a prism, without any explosion taking place."

"How curious!" said Harry. "What can be the cause of this? Why does not the bulb explode when you grind off the neck slowly? and why does it fly into pieces when the neck is snapped off? Why does it explode at all, Sir Rupert? Will you explain the reason to us?"

"I am not sure that I *can*," said Sir Rupert; "but I will tell you what, from all the facts that are known at present, I believe to be the cause. When a drop of melted glass falls into water,

* Dr. Brewster.

the outside of it, which first touches the water, is suddenly cooled, and becomes hardened and fixed before the inside parts have time to cool. You know, or you should know, that glass contracts as it cools. Now I suppose," continued Sir Rupert, "that the external crust of the drop cannot contract after it has been hardened, and that, as the inner particles continue to adhere to it, so neither can they contract into their proper space. Being thus kept in an expanded state, they are forced to remain beyond their natural distance from each other; and the thin hard crust has, I suppose, but just strength sufficient to retain them in this situation. Harry, do you understand so far?"

"So far I think I do, sir," said Harry.

"Then, by snapping off the tail of the bulb," continued Sir Rupert, "the particles of the glass are supposed to be thrown into a state of vibration, which suddenly detaches them from the outer crust; and, by permitting them to yield to their natural attraction for each other, produces the explosion which you heard. But if, instead of snapping the neck, we grind it away gently, no sudden vibration takes place, and the glass remains unshattered."

Sir Rupert paused; and the moment he did so Lucy thanked him eagerly, and said she was very glad that she now understood *all about* these wonderful drops, and the reason of their exploding.

Harry, too, thanked Sir Rupert for his explanation, but his thanks were more sober; and he looked as if he was not quite satisfied, and wished to know more.

Sir Rupert smiled, and said, "I am glad to see that you, my young friend, do not swallow an explanation without chewing it. Perhaps I have not made what I mean clear to you."

"I think I understand what you mean, sir," said Harry: "that is not my difficulty."

"What then, Harry? Tell me your difficulty."

"I do not know how you are sure that this is the right explanation. That was what I was considering, sir." Harry answered with diffidence, yet without hesitation.

"I am not certain that I am right," Sir Rupert replied, with kindness in his voice and look. "You may recollect that I began by saying, that I was not sure I could explain this phenomenon satisfactorily, but that I would tell you what I *supposed* to be the cause of it."

"I remember that you did, sir," said Harry; "but I thought you meant that you could not be sure of your explanation being intelligible *to me*."

"I meant more," said Sir Rupert; "that I was not, and cannot, be certain of it myself, because it has not been proved by satisfactory experiments."

"I wish some good experiments were tried upon the subject, to bring it to a certainty, then," said Harry.

"So do I," said Sir Rupert; "and I am glad that you feel this desire to ascertain the truth by experiment, the only certain way. But, Harry, this is a difficult subject; I advise you to put it by in your mind for future consideration. Remember clearly the facts, and do what you please with the suppositions. Some years hence, perhaps, it may return to your thoughts, when you may pursue it with more advantage than you can at present."

"Yes, when I have more knowledge," said Harry. "I will put it by in my mind, as you advise."

"But I hope you will not forget it," said Lucy, "as I do, when I put by things in my mind, and say I will think of them another time: I cannot find them afterwards."

"But this is likely to be recalled to your brother's memory," said her father, "when he learns chemistry, and studies the phenomena of crystallization."

"Besides, I shall recollect it from all the pleasure I have had at Digby Castle," said Harry.

"This is one of the many differences between cultivated and uncultivated young people," said Sir Rupert, addressing himself to their father, "that

you *can* give them more pleasure than you can to ignorant children. Prince Rupert's drops could only have given the pleasure of one moment's surprise—a pop and a start—and a laugh, perhaps, and there would have been an end of the matter with most children.”

As Sir Rupert spoke, his eyes chanced to turn upon Lucy, who blushed and looked very much abashed. When she was asked what was the matter, she said she was ashamed of having so hastily said that she understood all about these drops; she was afraid that Sir Rupert Digby had thought her conceited; and she imagined, that, when he looked at her as he spoke, this was what he was thinking of.

He comforted her with the assurance that he did not think her conceited; but he perceived that she was a little too hasty in supposing that she understood the whole, when she saw only a part. Of many grown up old logicians it has been justly said, that they see a little, imagine a great deal, and so jump to a conclusion. “Therefore,” he added, “such a young reasoner as Lucy may be excused, and need not be so very much ashamed of herself; but she will do well to try to correct this propensity, and to imitate Harry's caution. It is wonderful,” continued Sir Rupert, turning to Harry's father, “that people should have been so long in discovering the simple truth, that all

our knowledge of nature must be founded on experiment."

"What other method, then, did they take sir?" said Lucy.

"They guessed, or reasoned, without trying experiments to prove whether they were right or not," said Sir Rupert. "They laid down general maxims, which they took for granted because they had been found correct in a few instances."

"That must have been a bad way of going on, indeed," said Harry.

"Yes," said Sir Rupert; "when you come to read the history of the philosophers of old times, and of the *alchymists*, and the *adepts*, as they called themselves, you will see, Harry, what strange work they made of it, and what absurd things they believed were the causes of what they saw in chemistry. Of this there are a thousand instances; but I do not, at this moment, recollect one to give you."

"I recollect one, I believe," said Harry, "which my father told me when we were at the barometer, that, before people knew the reason why water rises in a pump, they used to say it was because *Nature abhors a void*."

"A good instance," said Sir Rupert; "and the best, or the worst of it was, that they were so well contented with this grand maxim, that they never thought of making further inquiry: they

became, moreover, so obstinate in error, that they could scarcely see or believe the truth when it was shown to them. You know they were ready to burn Galileo, because he proved that the earth was round, and not flat ; and that, instead of the sun moving round the earth every twenty-four hours, it was the earth that turned round its own axis."

Harry felt gratified and obliged by Sir Rupert Digby's addressing so much of his conversation to him : but what pleased him most was the candour shown by Sir Rupert. Instead of being displeased when his own explanation had been questioned, he acknowledged that it was doubtful, and observed that it ought to be brought to the test of experiment.

WORKSHOP.

THERE was a room at the east end of the library, which Harry and Lucy had not yet seen—Sir Rupert's workshop. He took them into it, and showed Harry his *turning-lathe*. He gave Lucy an ivory box, which his son had turned when he was last at home. The lid was ornamented with a profusion of circles, lying like rings, crossing over each other; and within the rings were pointed leaves, one behind the other, each delicately cut, and finely embossed. He showed Harry that simple and ingenious contrivance, the *eccentric chuck*, by which these ornaments had been produced; and, screwing it on the lathe, he not only explained the principle on which it acted, but the endless variety of devices that may be made, either by altering the position of the centre, or by changing the place of the tool. There was a piece of ivory in the chuck; and, when Sir Rupert put the lathe in motion, Harry was astonished at the quickness and accuracy with which these knots of circles were traced, and the ease with which the depth and breadth of each cut were regulated.

While Harry tried his hand and his foot at the lathe, Lucy looked on for a little while, admiring the "flying circle's speed;" but, as she stooped to pick up a curled shaving of ivory, which she thought was too pretty to be left on the floor, her eye was caught by the words *Chinese Serpents*, printed on a drawer under the workbench.

"Oh! sir," said she, "what are Chinese serpents? may I look at them?"

"Yes, you may open the drawer and look at them. You may take them in your hand: they will not bite you."

"Bite me! No," said Lucy, smiling, "I am not so foolish as to be afraid of their biting me. I know they are not alive."

But there ceased her boast; for starting back, after stooping over the drawer, she exclaimed, "They move, however! Harry, you may laugh; but I assure you, as I stooped down, to look at one of them, he put up his head, and looked at me; and see—there is another coiling his tail. How curious! I do not touch them, nor move any thing that touches them—here are my hands, not even near their drawer, so that I cannot have loosed any spring that could set them in motion—but perhaps opening the drawer did it."

"No: but that is not a bad guess," said Sir Rupert.

"Think again, Lucy," said Harry, "and you will find it out."

"First let me look at this conjuror," said Lucy, pointing to a painted figure of a conjuror, with a long beard, and cap, and wand, of which she saw glimpses under the serpents, at the bottom of the drawer; "May I have him out, sir?" said Lucy; "perhaps he may tell me something: I have a mind to consult him."

"Do as you please," said Sir Rupert; "but I think you had better consult your own sense."

"Yes, yes, so I will," said Lucy. "I am only in joke about the conjuror; but I just want to look at him, because, when I have satisfied my curiosity about him, I shall think better about the serpents."

As she spoke, she cautiously began to put her hand down through the midst of them, toward the bottom of the drawer, to seize hold of the conjuror, but the serpents all rearing their heads or tails immediately, she hastily withdrew her hand.

"I am afraid I shall do some mischief," said she.

"No, my dear," said Sir Rupert, smiling, "you will do no mischief to them, and they will do none to you. There is no danger."

"Danger! Oh, no, I know that," said Lucy; "but I think Harry had better be so good as to take him out for me."

Harry plunged in his hand, and drew up the

conjuror by the beard. "There he is for you," said Harry. "What good will he do you?"

"It is only a coloured print, on a paper case, now I see it in the light," said Lucy. "May I open the case, sir? there seems to be something in it."

As Sir Rupert assented, she opened it: within the case she found a yellow paper, on which were what Lucy called hieroglyphics; and inside were a number of little fish, about twice the length of the mother-of-pearl fish which are used as counters at a card-table; but these were not of mother-of-pearl, they were of some very thin material—thin as oiled paper, or as goldbeater's skin, and somewhat of that colour. As Lucy looked close, to see what they were made of—they began to move.

Sir Rupert took one by the tail out of the paper, and, bidding Lucy hold out her hand, he laid it flat upon the palm; at first it lay still, but in a few seconds began to move and heave its head and tail.

"Like the serpent," said Lucy; "but how or why they move I cannot conceive, because there is no room for any spring, or any mechanism, Harry, withinside. There is no double skin. He is quite transparent; I can see through him, and there is nothing in him. How he writhes about! But what says the conjuror? What has he to do with it? Let me look at his paper, and try if I

can make it out. It is not English—Kiobenhavn—does this mean Copenhagen?—Is it Danish?”

“Yes: this conjuror and his fish were brought to me from Copenhagen by an officer, long ago, before they became common in this country; and they afforded us then much amusement, trying the temperaments and fortunes, or at least the tempers and understandings, of those who consulted this conjuror, and took his fish in hand. Here is an English translation of his advertisement for you, Lucy.”

Lucy read, and learned that the conjuror promised to tell the temperaments, dispositions, characters, and fortunes of all manner of men, women, and children, by the aid of his fish. Mute, but not still, their motions spoke a language, which, as he boasted, could never, like the language of men, err or deceive; and this language he, to a certain degree, and in some general points, condescended to interpret, for the advantage of all who consulted him, and purchased his hieroglyphic scroll. Opposite to the hieroglyphics, on this scroll, were the interpretations of the different motions of the fishes’ heads, and tails, and bodies; also what was to be inferred from their lying still and motionless.

“Now I understand the directions, let us try on ourselves,” said Lucy. “Hold out your hand, Harry.”

She placed one of the fish flat on his palm, and observing its motions, which were quick and sudden, floundering with his tail, she consulted her hieroglyphics, and found that Harry was "sanguine and choleric—fortunate in war."

"That is not true, I can answer for it," cried Lucy, "as far as the choleric and sanguine go. Now try *me*."

"Atrabilious and melancholious; to die of a broken heart, if not taken in time."

Lucy let fall the fish, while she laughed and exclaimed, "What nonsense!"

The fish fell into some water, which was kept in the workshop for the use of the grindstone. Recovering from her laughter, she said that he was at last in his proper element: yet he did not seem to like it; his head and tail curling up met, and he lay with only the middle of his side touching the water, as if he feared to go in.

"Put him quite in," said Harry, "and see what will happen."

Lucy pressed him down into the water, but not without his struggling: however, when he was fairly in for it, as she said, he ceased to flounder, and lay perfectly quiet.

"Now let us take him out, and dry him," said Harry, "and see what will happen."

Harry dried one of his sides, and laid him down in the sunshine.

"Oh! the poor fish," cried Lucy; "he is just as the proverb says, as uncomfortable as a fish out of water. How he writhes about. I'll sprinkle a little water over him."

"Stay, let me dry him quite, and that will do as well, you will see," said Harry; "he will lie quietly then, though he is a fish out of water."

"Well, try," said Lucy. "Now he does lie quiet, indeed; exactly as if he were dead."

But, as she stooped closer to look at him, he seemed to revive, and moved again.

"As if he felt my breath," cried Lucy. "Oh! Harry, I see how it is now: I know it all."

Harry smiled.

"You are right," said Sir Rupert.

"And you knew it all the while, Harry," said Lucy. "I was very stupid not to think of it before."

"You would have thought of it," said Harry, "but that you were so full of the conjuror."

"But even now I do not know all," said Lucy. "I suppose that the motions of this fish depend on the changes from wet to dry; and that he curls and uncurls as my hair does, and for the same reason. I have not forgotten, Harry, all you and papa explained to me about the cause of curling, when one side is wet, and the other dry; when the pores are filled with moisture on one side, and not on the other. I understand that that was the case

with the fish, when you dried him on one side, and left him wet on the other. But I cannot yet guess of what substance he is made."

"Think of some of those substances of which you know hygrometers are made," said Harry.

"Old whalebone hygrometer! I remember you," said Lucy. "You smile, Harry. It is whalebone; but I never saw any before so thin."

"Very likely you never did," said Harry; "but whalebone can be scraped very thin—as thin as this you see."

"It really is whalebone then; and I could make such a fish myself," said Lucy. "If my head had not been so full of that foolish conjuror, I might have seen all that you observed, Harry, and then I should have found it out too."

"I dare say that now you will find out what the Chinese serpents are made of," said Sir Rupert.

"They are hygrometers too, then, I suppose," said Lucy: "eh, Harry? What can they be made of: do you know?"

"I am not sure, but I believe I do," said Harry.

"Yes, you are right," said Sir Rupert, following the motion of Harry's eye.

Lucy turned and looked, yet she saw nothing, as she said, but dust under the workbench; "and a box full of old iron, and brass, and hundreds of things," continued she, going towards it.

“You had better stop, and think, instead of going into that box,” said Harry. “Look back at the serpents, and see what they are like. Recollect all the substances which you know would make good hygrometers, and then consider which is most like these serpents.”

“Ivory!” cried Lucy. “I remember you told me that it has many pores, and that it makes a good hygrometer: they must be made of ivory. And now I know what your eye turned to: it was to that curled shaving of ivory which is lying on the floor.”

Sir Rupert, after some conversation with Harry about hygrometers, asked him if he had ever seen Daniel’s; and, when Harry answered that he had not, Sir Rupert exclaimed, “Let whoever is curious in hygrometers follow me to the laboratory.”

Harry followed instantly, but Lucy did not: she thought she had had enough of hygrometers; and she preferred going to divert herself with a canary bird, which she saw hanging in its cage at the window of the housekeeper’s room, on the side of the court opposite to the laboratory. This bird could, as the housekeeper told her, draw up water for itself in a little bucket. She saw this bucket. It was about the size of a thimble. It hung by a delicate chain, on the outside of a sort of projecting bow window in the cage: the upper

end of the chain was fastened to the bird's foot, and the bucket lay in a small reservoir of water. The manner in which the bird drew it up was, as the housekeeper told Lucy, by taking the chain in his beak, and by placing his foot on each portion of it, as it was drawn up, till the bucket was as high as the little window, where he could drink.

He disliked, it seems, the labour of drawing water, and never performed this operation except when compelled by thirst. Unluckily for Lucy, just before she arrived he had drawn up a bucket-full, and, having satisfied his thirst, he was now singing away, loud and shrill, as if rejoicing in having cast dull care behind him. Lucy waited and waited; she and the housekeeper exhausted all their exhortations, all the endearing epithets in the language, and all their hemp-seed, in vain. The canary took all the bribes as fast as they were offered, and received all the compliments seemingly in good part; but no return made he: not that he did not understand what return was expected. The rogue eyed the bucket askance, as the housekeeper held it up to him; then straight he turned his back upon her, or upon it, and sang away, pertinaciously, with a louder and a shriller note than before. A full quarter of an hour was spent upon him; then Lucy gave it up.

“What an obstinate or capricious little creature

it is!" said Lucy. She then went to ask Lady Digby whether it hurt him to draw up the bucket.

Lady Digby said she believed it did not hurt him, though she could not be certain; but she thought his unwillingness to perform the operation might be accounted for, by recollecting the pain which he had undergone in learning this feat. It is said that much cruelty is practised on birds, when young, in teaching them this and other accomplishments.

HYGROMETERS.

“BEFORE I show you the new hygrometer, Harry,” said Sir Rupert, “I must tell you, that in all those hygrometers which are made of vegetable or animal substances, and which measure the moisture of the air by their expansion or contraction, there is one great source of error—they have no standard point by which they may be readily compared with each other. The great De Saussure, whom you will admire still more for his candour than for his ingenuity, foresaw, and pointed out this fault in his own hair hygrometer; and the celebrated Humboldt, who used both the hair and the whalebone hygrometers, complained that he could never make their results agree: another philosopher calls all the ordinary hygrometers mere toys: but, without going further, it is enough for you to know, that, from this cause, all those instruments are found to be insufficient for making nice observations on the atmosphere. They have, besides, other imperfections: no two hairs are exactly similar in elasticity; whalebone is not only very irregular, but very slow in its expansion; the

wind disturbs their movements ; and dust and oil, in time, clog the pivots. Such are the principal faults of the old hygrometers.

“ Now for the new one. You have, I dare say, often observed the dewy appearance on the outside of a glass of cold water when brought into a warm room. This dewy appearance, you know, is caused by the condensation of the moisture contained in the air, and it was this circumstance that first suggested to Mr. Daniell the idea of measuring the quantity of moisture contained in the atmosphere by the degree of cold that is required to condense it ; as the damper the air is, the greater will be the facility of condensation. Now, by observing how many degrees cooler than the atmosphere it is necessary to make any substance before dew will be formed upon it, you may obtain the measure of the quantity of water supported in the air. This you might easily do for yourself, by trying how cold a bottle of water must be to become dimmed with condensation. All that is necessary is to observe the different heights of two thermometers at the same time, one in the water, and one in the air. It was in this manner that Mr. Daniell tried his first experiments, till he succeeded in making the ingenious instrument which I am going to show you, in which the artificial cold necessary is produced by the rapid evaporation of ether.”

He placed before Harry's eyes a brass stand

and pillar, five or six inches high, to which was attached a thermometer. Across the top of this pillar Sir Rupert placed a glass tube, each end of which was bent down, and ended in a hollow ball or globe. One of these balls was about half filled with a liquid which, Sir Rupert told Harry, was ether; it contained also a thermometer, the bulb of which was half covered by the ether. The other ball seemed to be empty, and was covered on the outside with muslin.

“In the first place you see, Harry,” said Sir Rupert, “these two thermometers. The one attached to the brass pillar is to show the temperature of the air, while the other shows the temperature of the ether in the glass ball in which the thermometer is placed. I should also tell you that all air has been excluded from this tube and its two glass balls, so that they contain nothing but the ether which you see in one of the balls, and a vapour formed from the ether too thin to be visible.

“Now let us place this instrument in the open window; and, when I wet the muslin covering of the empty ball with a few drops of ether, you are to observe what takes place on the other ball.”

It was what is called a very dry day, and, after Sir Rupert had applied the ether two or three times, Harry said that he saw a slight film of dew forming like a ring round the uncovered ball.

“Now, Harry,” said Sir Rupert, “mark the height of both thermometers.

“You are aware,” he continued, “that rapid evaporation produces cold; and that ether evaporates more rapidly than any other fluid.”

Harry was aware of this, yet he was surprised by the instantaneous cold produced by a drop of ether that Sir Rupert let fall on the back of his hand.

“When I applied some ether to the muslin,” said Sir Rupert, “the glass ball which it covers was immediately cooled by the rapid evaporation of the ether, and, as the glass cools, it condenses the vapour which, I told you, filled this apparently empty ball. Now, to supply the place which this vapour occupied, more vapour is formed by evaporation from the surface of the ether contained in the other ball; and this evaporation cools the ball containing the ether down to the degree necessary to condense the moisture in the atmosphere. What degree that may be is shown by the thermometer in the ball at the moment the film of dew is deposited on the outside; and the *difference* between that and the temperature of the external air is the measure we want of the quantity of moisture suspended in the atmosphere.”

“Then I suppose, sir,” said Harry, “the drier the air, the greater is the difference between the thermometers.”

“You are right, Harry. If there had been a large proportion of moisture in the air, a few degrees of cold would have been necessary to condense it, and you would have seen the film of dew immediately follow the application of the ether to the covered ball. On the contrary, when the air is very dry, a considerable increase of cold is requisite, as you have found to be the case to-day; the thermometer in the ball having fallen fifteen degrees below that in the air, before any dew was deposited on the ball.”

After this explanation, for which Harry was very thankful, Sir Rupert advised him to look at the inventor's own description of the instrument in the *Quarterly Journal of Science*, No. xvi.

“But first,” said Sir Rupert, “let us go out, if you please, this fine day, and have some exercise and some amusement. Remember the bow must not be always bent. By-the-bye, here are bows and arrows, and here is a little bow, which Edward had when he was your age, which will just suit your sister Lucy. Call her, and bring her out with you to the bowling green: I will have the target set up for you.”

ARMOURY.

“AN hour and a half! Is it possible,” said Lucy, “that we have been really an hour and a half here on this bowling green?”

“Exactly an hour and a half since first I fixed an arrow in that bow, and settled it in your hand,” said Harry; “for I happened to look at the sundial just as I went back to my place.”

“We have been so very happy!” said Lucy, stretching out her arm to rest it.

“But now you seem to be rather tired of your happiness,” said her father, “and you had better stop before pleasure turns into pain.”

“My arm only is tired, papa,” said Lucy; “I am not the least tired myself. However, I think we have had enough for to-day, and we can come back to it to-morrow, if to-morrow should be as fine as to-day.”

“In the mean time come with me to the house,” said Sir Rupert. “This way leads towards the old part of the castle; I will turn you into a cool armoury to rest yourselves, and where perhaps you may find fresh amusement in looking at the bows and arrows of former times.”

They followed joyfully to the armoury : he showed them, in the first place, a bow and arrows which had remained in this castle—family tradition failed to tell how long ; but certainly since the days of our Henrys and Edwards, when bowmen and archers flourished, and when bows and arrows were not as now taken up as matters of amusement, by fine gentlemen and ladies, to win prizes at festive meetings, but employed as serious weapons in battles and sieges. Sir Rupert was going on to show Harry the cross-bow, such as was in use and repute among our ancestors ; but Lucy's eye was caught by an Indian bow and arrow, and he turned to take it down for her. It was stiff with rings of dried thongs of leather, which had been put on the bow to commemorate each savage victory obtained by the owner. Next to this Indian bow there hung another, said to have been brought from Mexico, at the time when those poor people, or, unhappily for them, those too rich people, were invaded by the avaricious Cortes, and when their bows and arrows so ill defended them against the fire-arms of the Spaniards. Harry and Lucy regretted the fate of the inoffensive Mexicans, and wished that they had been possessed of the ingenious invention of fire-arms for their just defence.

Sir Rupert went back to the cross-bow, and showed Harry how it was constructed and used.

The stock or handle was made of wood, neatly inlaid with bone, and ornamented with tassels ; but the bow was of steel, and so stiff, that Harry's utmost efforts could scarcely bend it. Sir Rupert told him that no person had sufficient strength to draw back the string into its place, without some mechanical assistance, and, putting the bow into his hand, desired him to examine it carefully. Harry observed a long iron lever, the end of which turned upon a pin in the middle of the stock. Near the pivot upon which this lever moved, there was a little arm attached to it, which terminated in a kind of hook, that seemed to invite the string : he slipped the string over the hook, and, pulling round the end of the lever down to the butt-end of the stock, he easily accomplished the bending of the bow. Sir Rupert then showed them the trigger, or *serpentine*, as he said it was formerly called, by which the string was released, and the arrow or ball projected.

Harry was surprised to hear him mention balls ; still more when he was told that balls both of lead and stone were used. Sir Rupert showed them also various kinds of darts and arrows, one of which, to Lucy's great amusement, he called a *quarrel* ; he explained to her, however, that the term was derived from the old French word *quarreau*, on account of its *square* head of iron. Cross-bows and quarrels, Sir Rupert added,

were much used in the time of Henry the Second.

In this armoury were many of the warlike instruments and armour used in ancient times by the English. Sir Rupert showed Harry the *helmet*, the *vizor*, and the *lance*; and explained to him how the lance stood in the *rest*, when the knight was on horseback; and he showed him all the parts of the knight's armour, with which he cased himself and his horse in iron, so that, as long as he and his steed could hold together, they were almost invulnerable, till the lance was wrested from his hand, or his foot *ousted* from the stirrup. The united weight of man and horse, or their joint momentum, was of great consequence, as the heavier they were, the greater the shock with which they came against their adversary, horse to horse, and man to man. Harry and Lucy were glad to know the exact appearance of all these things, of which they had read in history, as being used not only in battles, but in the *justs* and *tournaments* of former days.

Lucy enjoyed them from the recollection they brought to her mind of many passages in poetry, and from the pleasure she always felt in whatever filled her imagination.

Harry's mechanical taste was gratified by examining the ancient coat of mail, or *hauberk*, consisting of small steel rings, linked

together, or interwoven, in the manner that some ingenious purses of steel rings are made at this day.

After Harry had satisfied his curiosity, Sir Rupert took him on to those later inventions, which made of no avail "helm and hauberk's twisted mail." He showed him some of the first rude attempts at fire-arms; the *arquebuse*, or long gun, described by Froissart, used with a rest, upon which it was supported, and with a sort of shelter-piece to protect the match from wet and wind. Between this first clumsy attempt to execute that grand invention, and the perfected Manton's and Forsyth's guns of our own times, various improvements were made, some of which Sir Rupert explained to Harry. Lucy, whose curiosity was not only satisfied, but satiated, went off to seek for amusement and information more interesting to her, in the garden and the conservatory, with her mother and Lady Digby. Indefatigably kind Sir Rupert ended by finding "Froissart" for Harry in the library, and unfolding for him those delightfully entertaining old prints, where the battles of Poitiers and Cressy are represented so happily, though in defiance of all the laws of perspective.

After speaking of the wonderful change which the introduction of fire-arms produced in the world, and of the astonishment which their first

appearance created among civilized and uncivilized nations in Europe and America, Sir Rupert related to Harry an account, which he had just read in a new book of travels, of a people by whom the power of fire-arms has been even recently defied.

“Between the Nile and the desert,” said Sir Rupert, “there is a narrow strip of cultivated land, which in some places is not more than half a mile in breadth, but which stretches hundreds of miles in length. This strip of land was inhabited by various independent tribes till within the last three or four years, when a despotic Turkish Pasha, of the name of Mahommed Ali, resolved to send a large army, under the command of his son Ismael, to subdue them. Ismael’s progress was unresisted, till he came to one warlike tribe, who, with equal courage and patriotism, defied the invader. ‘He may drive us to the gates of the world, but we will never submit,’ was the answer they sent to his threats.”

“Brave people!” cried Harry. “I hope they drove him back again.”

“They were heard shouting from their encampment,” continued Sir Rupert, “‘You may come against us from the north, and from the east, and from the west, but we will never submit.’ They knew that the Pasha had fire-arms—they had none—but they put their trust in the weapons

and shields to which they had been accustomed, and in their own courage. Their shields of hippopotamus, or of crocodile skin, covered the head and the breast. Their weapons were swords and lances : and their sorcerers assured them, that their shields and themselves should be rendered by magic invulnerable to musket balls.

“ Bravely they came out to give him battle, and advanced boldly at first ; but, when the volleys of musketry began to play, and when they found that, in spite of their promised invulnerability, many fell wounded and killed, a panic seized them, and they fled. After this first defeat, however, they entrenched themselves in their mountains ; their courage revived, and again they sent forth shouts of defiance, bidding the Pasha ‘ to come if he dared.’

“ But Ismael had learned to respect their bravery : he had once already been surprised and almost defeated by the black horsemen of the desert, and he therefore prudently resolved to attack them with a heavy fire of shot and shells. One of these shells fell amongst them ; and, as it was rolling and bounding along, these poor ignorant people gathered round it, admiring and amused by its motions ; but when it burst, and spread destruction round it, they cried out, ‘ The evil spirits are come against us, and are too mighty for us.’ The superstition, that had at

first given them confidence, now only served to increase their despair; and, abandoning their strong holds, they set off in full flight, their patriotism expiring with their liberties. Afterwards they bargained for their wretched lives; and were contented to join, as his soldier slaves, the army of their conqueror."

As Sir Rupert concluded, Harry groaned. "Was this," said he, "the end of their glorious 'You may drive us to the gates of the world, but we will never submit?'"

"Even so, Harry; so little dependence can there be on mere animal ignorant courage, that braves the danger of which it does not know the nature or extent."

CONSERVATORY.

THE glass doors at one end of the library, leading into the conservatory, were half open ; and, now that Harry's attention was no longer engaged, he observed a gale of fragrance, like the smell of fresh hay, or of that grass (*anthoxanthum odoratum*) which gives to fresh hay its pleasant odour. A second waft, however, decided that it was from Lady Digby's favourite plant, the heliotrope, innumerable pots of which the skilful old gardener contrived to force into premature flower and perfume, so as to have a constant succession for her ladyship's conservatory. He heard Lucy's voice too ; and, though he was not, as he used to say of himself, a great green-house merchant, he now went in there, and found Lady Digby showing some plants, which had been lately sent to her from North Carolina by a kind American lady. There was one which is rather uncommon in these countries, as it is so delicate that, without care, it seldom survives a winter in our climates. It is something of the nature of the sensitive

plant ; the inside of the leaf is thickly set with bristly hairs, like thorns, or like many little sharp teeth. As soon as Lucy saw this plant, she took up a straw, and drew it along the division, or middle rib of one of its leaves, and immediately the two sides of the leaf folded up, and the prickly teeth closed together, so as to hold fast the straw.

“ I see it is the plant I thought of,” said Lucy. “ Venus’s fly-trap, is not it ? ”

“ Yes, *dionæa muscipula*,” said Lady Digby ; “ have you seen one before ? ”

No ; Lucy had never seen one, but she knew it, she said, from having read a description of it. The gardener by this time had caught a fly, of which he had been in search on the window for some time—for flies were few and rare at this season—and, holding his struggling prisoner by the two wings, he was going to set him upon one of the leaves, that the young lady, as he said, might see what would happen ; but Lucy stopped his hand—she knew what would happen—that the moment the fly touched the leaf, the teeth would close upon it, as they had closed on the straw, and squeeze it to death. The old gardener immediately complied with Lucy’s entreaties to release the poor fly ; and Lucy observed to him, that there was the less occasion for this experiment, as the many dead flies showed how well

some of the leaves had performed their cruel office. "But I really think," she said, "that those fly-killing leaves are larger and greener than the rest."

The gardener answered, that he had often remarked the same thing; and, though some folk said that they were fattened and nourished by the dead flies, for his part he thought it just as likely that it was because the healthy and vigorous leaves had a greater power of shutting close and crushing the flies. "But," added he, with due philosophic caution, "I can't take upon me to decide."

Harry admired the ingenious mechanical structure of this fly-trap, and began to say that it reminded him of something which he had seen elsewhere; when Lucy smiled, and said, "I know what you are going to say, Harry, and you are quite right: you mean the plant called the fly-catcher; a sort of *arum*, which has a smell, as you said, Harry, like a dead horse. And there is another plant, in which mamma showed me the same sort of contrivance," continued Lucy; "but I cannot recollect its long Latin name. I remember that papa lent me a magnifying glass to look at the dead flies lying at the bottom of its flowers: some were held by the proboscis, and some by the legs. This plant is called in Eng-

lish, I believe, *dog's-bane*. Was not this what you were thinking of, Harry?"

"No, I was not thinking of any plant," said Harry; "I was thinking of a machine; a sort of trap, which catches rats in the same manner that this catches flies."

Lucy was a little scandalized by this inelegant comparison.

"The fly-trap of Venus compared to a rat-trap!" But, on Harry's appeal to his father, it was allowed to be just, as far as mechanics go.

The gardener thought it was now his turn to get in a few words in praise of the strength and healthiness of his *dionæa*. It had been sent over from Carolina in sods of its native earth, which still remained in a box to which he pointed. "There were more plants in it," said he, "but they have died; so I shall empty out the sods now, for they are a disfigurement here."

Harry said it would be a pity to throw this earth away; for he recollected having heard, that when the boxes of plants, which Perouse, in his voyage round the world, sent home to France, were opened, the plants and shrubs in some were dead, yet the gardener did not throw away the earth, but preserved it carefully, because he thought it might contain the seeds of some sorts

of plants unknown, perhaps, in these countries; and so it proved.

Lady Digby, upon hearing this circumstance, desired her gardener to put the American earth into small pots, and to place them in a hot bed. "If it should produce any plants that are worth your acceptance, Harry," said she, "you, to whom I shall owe them, shall share them with me."

"Mayhap, master, you might not know what this is?" said the gardener, opening another little box, and putting into his hands a small bundle of what seemed to Harry to be black horse-hair.

"Is it horse-hair?" said Harry.

"It is horse-hair," said Lucy.

"No, miss—no, master; though I took it myself for that at first unpacking."

Lucy pulled a bit of it out; and, after feeling, said, "It feels like horse-hair, crisp, and springy; and it looks so like it, that I can hardly believe it is not horse-hair."

"Never was on a horse's back, miss, nor ever belonged to any animal."

"Is it animal or vegetable?" said Lucy.

That was soon settled, by Harry's running back to the library, and burning a bit of it; the remains he held to Lucy's nose, and its smell convinced her of that which her eyes had failed to discover, that it was neither horse-hair, nor

any animal substance. "Then it is a vegetable. What can it be?"

"And what do you think this can be, miss?" said the gardener, putting into her hand another little bundle of something which, Harry said, looked like ends of white coarse thread, such as he had seen in a tailor's shop, and which he had heard called *thrums*. Lucy agreed that it was like tangled housewife's thread; but on a nearer view, she, who was more knowing in housewifery than Harry, pronounced that it certainly was not thread. Looking at what Harry drew out, and called a needlefull, she observed sundry little short filaments, or stalks, and at the end of some of them were little knobs, which, on further examination, were evidently the remains of very small flowers: she pronounced it therefore to be a vegetable; and she was surprised to hear, that both this and what she had called black horse-hair were one and the same thing, only in different states.

"I will, if you please," said Lady Digby, "read to you the account that I received from the American friend who sent them to me."

She returned to the library to look for the letter in her writing-desk, and Harry and Lucy stuck close to her, much afraid that the letter might not be forthcoming; but she found it, and read as follows:—

“ ‘The foliage of several trees here’ (near Wilmington, in North Carolina) ‘has, in some situations, a singular appearance. A sort of long grey moss suspends itself from the branches, and, waving in the wind, gives the trees a hoary, and to me not uninteresting, appearance. When stripped of its external coat, this moss nearly resembles horse-hair. It is collected for that purpose in large quantities, and buried in marshy spots; and, when the outer coat peels off, the inner part is dried and cleaned, and makes excellent mattresses.’ ”

Lucy’s mother observed, that the woody part of flax is destroyed in the same way, by steeping it in water.

Lucy inquired whether this kind of horse-hair moss, as she called it, had any name; and whether it was known in England, or was a new discovery. Sir Rupert Digby told her, that, though he had never before seen this extraordinary fibrous *species*, yet he was aware that the *genus* or family of plants to which it belonged, had been well known to Linnæus, who had given it a singular name, from a singular circumstance.

“It will make me remember the singular name,” said Lucy, “if you will be so good as to tell me the singular circumstance.”

“You must know then,” said Sir Rupert,

“that, among the early botanists of Sweden, there was a certain doctor, who, having in his youth had an unfavourable voyage by water from Abo, where he lived, to Stockholm, made a vow, the moment he set his foot on dry land, that he would never again venture himself upon the sea. He kept this vow so scrupulously, that, when he was to return home, he took a roundabout journey of several hundred miles, to avoid a passage of a few hours by water. His hatred of water, and his love of the dry land, rose to such a pitch, that he laid aside his family name to take that of *Tillands*, which in Swedish means *on land*. You think, perhaps, and so do I, that this doctor made a rash vow, and did not in all this show much sense. But a man may be weak in some things, and wise in others. He was wise in botany, and made an excellent catalogue of all the wild plants in the neighbourhood of his residence; in honour of which, and of the whimsical name he had adopted, Linnæus gave the name of *Tillandsia* to this genus of plants, as they are remarkable for their dislike of water. Lucy, do you think you will now be able to remember the name *Tillandsia*?”

“I think—I am sure I shall,” said Lucy.

Sir Rupert further told Lucy, that one of the most severe censors of Linnæus had been so much pleased with the happy choice of this name, that

he declared he would excuse in Linnæus a thousand faults for that fact alone.

Lady Digby said, her American friend had been so obliging as to send many other curious things in the box, besides the specimen of this moss. "Among others, I am sure, Lucy, you will like to see some pods of cotton, in their different stages of ripening. My friend tells me that they grow on a bush from two to four feet high, and that the flower is of a delicate straw colour. I dare say you may have seen an engraving of it."

"I think I have," said Lucy. "But oh! Lady Digby, before you shut the box, will you give me leave to look at that green leaf—if it is a leaf?"

"You do well to say, if it is a leaf," answered Lady Digby. "Do you know what it is?"

"Is it the *creeping leaf*?" said Lucy.

"No," answered Lady Digby. "It much resembles the creeping leaf, or *mantis strumaria*; but this is a different insect: by the country people in America it is called the *catydid*, from the sound of its chirping resembling the frequent repetition of Catydid! Catydid!"

Lucy examined this insect more closely. It was about the size of a rose-leaf, of the pale green colour of the inside of a pea pod, and apparently of that smooth texture: but, upon looking at it

with a magnifying glass, Lucy saw, that what had appeared like the veins of a leaf were the ribs or sinews of the wings; and in the intermediate spaces, which had, to the naked eye, appeared perfectly smooth, she now saw, embossed, innumerable little spots, looking like shagreen.

“ Now I see the animal’s head, where the foot-stalk of the leaf seemed to be, and its eyes, nose, and mouth,” cried Lucy. “ Pray look, Harry ! Its head and face are like a horse’s head and face in body clothes : look at its protuberant bladder-looking eye ; the mouth, however, is like a pig’s, or the ant-bear’s, and round its neck it has a curious worked pelerine, standing up like the leather *hood* on the collar of a waggon horse. But what curious thing is that lying loose in the box, with its green long-jointed stork-like legs ? What do they belong to ? ”

Before her question could be answered, her rambling eye fixed with delight and curiosity on a plant which hung flaunting from the top of the conservatory : she asked where its roots were, how it was nourished, or whether it lived on air ?

Lady Digby answered, that it was reputed to live on air, as its name of *flos aëris*, or the air-plant, shows, and that probably it derives its nourishment from the moisture in the air. “ How-

ever this may be in its native country, here it thrives much better if planted in a little light earth, or even in wet moss, as you may perceive, by comparing it with the other specimens which you see twined round that pillar, and which are all planted in pots. This plant, nevertheless, has been hanging where you see it for four months; and, though it requires a much greater heat, it is quite alive. It is frequently watered, and I want to try how long it will live in that situation. But," continued Lady Digby, "if you, my dear Lucy, who are so active and obliging, will run up stairs to the little turret, within my room, you will find upon my desk a book, with many paper marks in it: bring it down to me, and it will tell you something more about this curious plant."

Lucy vanished, and re-appeared, bearing in her hand the proof of her swift errand.

"This is a favourite book of mine and of my son Edward's. All these marks he put in for my edification. I was no botanist, but he and this little volume together have made me fond of what appears to me the most interesting and rational part of the study—that which opens to our view the curious and useful structure of plants, and the progress of vegetation. I like this book for another reason," continued Lady Digby, turning to Lucy's mother, "which makes me

rejoice that it pleases young people. Without any ostentation of religious sentiment, it really inspires it in the best and happiest manner. Here is the account of the *flos aëris*," continued Lady Digby. "Will you read it to us? It is very short."

Lucy read:—"There is one species of the *epidendrum* family, the *flos aëris*, a native of India, that deserves to be particularly distinguished. It is so called, because it grows and blossoms when suspended in the air; and we are assured, that, hanging from the ceiling of a room, it will vegetate for years: it is likewise said to be remarkably reviving to the inhabitants, by the fine odour of its blossoms.'"

"That fact," said Lucy's father, "of its hanging from the ceiling of a room, and vegetating for a length of time in that manner, is mentioned, if I recollect rightly, in one of Sir William Jones's letters, written when he was in India. He says, the *flos aëris* was at that instant suspended over his head; that he had tied its rootless branches to the beams of the roof; and he speaks with delight of the charming fragrance of the blossoms."

"And now," said Sir Rupert, "pray may I ask—I have been very patient while you ladies have had the book to yourselves, with three pair of hands upon it at once—may I ask the name of

this favourite book, if name it have; for hitherto I have heard it called only *it*, or *the* book, or *my favourite* book: has it a name?"

"It has a name," answered Lady Digby, "and a name that will be well known to fame in due time—'Dialogues on Botany.'"

A STILL.

NEXT morning, after breakfast, an express came from the housekeeper's room to inform Lucy that the canary-bird was beginning to draw up his bucket. Down stairs she ran immediately, and after her followed Harry.

The thirsty little fellow, now working for his own interest, and with his own good will, soon performed his task, and earned his thimblefull duly raised. When lifted to the proper height, he held it, by keeping the collected chain fast under one foot. Then he dipped, shook his beak, and dipped and shook again, much to his own delight, and to that of the spectators. When he had fully satisfied his thirst he began to favour the company with a song; but his notes, even when joy tuned his throat, were so loud and shrill, that his mistress, the housekeeper, soon threw a white handkerchief over the top of his cage to reduce him to silence, so that, as she said, "she might hear somebody speak besides him."

Lady Digby, who had followed Lucy to see her

friend the canary-bird perform its little exercises, confirmed Lucy's hopes, that birds may be taught by gentle methods, when young, many of those feats which are generally acquired by the infliction of so many tortures. She had, when abroad, as she told Lucy, known a German music-master, who was very fond of birds, and who was most expert in teaching them. He assured her, that he had himself instructed a bullfinch, which he would venture to say was as accomplished as any of its kind in all Germany, where these birds are chiefly born and bred; and he had never used hot knitting-needle, or any other instrument of torture, in its education—only soft words, and sometimes, he acknowledged, a little wholesome fasting. Lady Digby recollected that this judicious bird-fancier, or bird-instructor, further told her, that he always taught his pupil at the dead still hour of midnight, or when all the rest of the family were asleep, and when there was nothing to distract the bird's attention. Then he would play tunes for him on the violin. The bullfinch seemed to take no notice, and never attempted at the time to follow him, but the next day he would practise by himself, and at last bring out the tune he had heard at night.

Looking out of the window to the other side of the court, Harry observed that the iron door was open, which was a sign that Sir Rupert was in the laboratory; and on this hint Lucy immediately

ran there with Harry, and found Sir Rupert and their father.

Fortunately for Lucy, Sir Rupert wanted, for the experiment he was then trying, to have some water that should be perfectly pure: that is, quite free from all mixture of earth, or salts, or other substances; and for which purpose it was to be distilled. This was a simple process, which Lucy could understand. Sir Rupert had just prepared his *alembic*, the apparatus usually employed in distillation for chemical purposes. It was a pear-shaped glass vessel, into which the liquor to be distilled was put; a lamp was placed underneath, by the heat of which the liquor was made to boil, and the vapour that rose was condensed in the cover, which was a conical-shaped cap of metal, with a *beak*, or spout, that sloped downwards into another vessel, called the *receiver*.

"These drops," said Sir Rupert, "which you see running off from the beak, are collected in the receiver; and the liquor thus collected is said to be distilled. All distillation is performed upon this principle, though the apparatus is different for different purposes, and sometimes made of copper."

"I have heard of a *worm* used in a still; what is that?" said Lucy.

"The worm is a spiral tube, so called from its resembling the form of a worm: its use, in the still, is the same as that of the cap over this *alembic*, to condense the hot vapour."

Lucy asked why the worm was used instead of the cap ?

“ Because,” said Sir Rupert, “ it exposes more cold surface to the vapour. Suppose the whole pipe to be unwound and laid open, you would then perceive what a large surface there would be. Besides which, the colder the worm is kept the quicker the condensation proceeds ; and a worm, or a long pipe coiled up, is very conveniently placed in a vessel of cold water, which may be changed whenever it becomes warmed by the hot vapour that communicates its heat to the metal worm.”

“ I understand it now, thank you, sir,” said Lucy.

She perceived that, in fact, though the apparatus was different, the thing done was no more than what she had formerly seen when she was six years old, when the cold plate was held over the vapour of boiling water that issued from the top of the tea-urn. She recollected something of the account of distillation and sublimation in “ Conversations on Chemistry,” and, searching for the book in the library, she refreshed her memory by reading the passages over again at this moment, when she had the advantage of seeing the real things, and perhaps of seeing the experiments tried.

She there found that *sublimation* is the name given to the process of distillation, when applied to solid substances.

“Sublimation — a sand-bath — flowers of sulphur,” she repeated, wishing earnestly that she could see all these things.

Sir Rupert said that, as the sand-bath was now heated over his little stove, for his own experiments, he could easily gratify her curiosity. If she pleased, he would, however, instead of flowers of sulphur, let her see flowers of *benzoin*.

He put into her hand a small lump of a brownish substance, which he told her was benzoin : and that it was a *resin*, or more properly a *balsam*, obtained from certain trees which grow in the East Indies, chiefly in the island of Sumatra. From this substance flowers of benzoin are obtained by sublimation, in the same manner as flowers of sulphur are produced. Lucy watched the process.

The benzoin was put into the glass alembic, which was placed in the sand-bath ; and this she saw was merely a cast-iron vessel, containing a quantity of sand. Sir Rupert explained to her, that the heat was more uniform, and could be better regulated by means of the hot sand, and that there was less danger to the glass, than if it were exposed to the direct heat of the fire. He told her also, that chemists make much use of a bath of boiling water ; and that in some arts, tempering certain kinds of springs for instance, workmen use baths of melted lead, or tin, or some other fusible substance, because the exact temperature at

which these metals melt being known, the proper heat may be applied with the greatest precision.

In a short time the benzoin began to swell ; the resinous parts, and other impurities with which it had been combined, remained at the bottom of the alembic, but the volatile parts flew off, and were condensed by the cold cap. These were the flowers, and were different from what Lucy expected to see. They were more like flakes of snow than anything else to which she could compare them. While she was looking at them, Harry ran out into the yard to the gardener's boy, whom he saw coming in from the garden, with a basket of herbs on his arm. From his basket Harry plucked a sprig of rosemary, and returning without letting Lucy see what he had in his hand, he sprinkled it over with flowers of benzoin, and then held it before her eyes.

"It looks exactly as if it were covered with hoar frost!" cried Lucy. "How beautiful! I shall never forget this, Harry. But here are the horses coming out for Sir Rupert and papa to ride, and so there is an end of all things—at least in the laboratory, for this day."

MAGNIFYING GLASSES.

BATTLEDORE and shuttlecock was kept up one rainy morning by Harry and Lucy—believe it who may, boast as much who can—two thousand three hundred and twenty-four times. They had also many a game of nine-pins in the great hall, where, prolonged by its echoes, was often heard the heart's light laugh at the fall of the merry men all.

But all these the promised joys of Digby Castle, each proving greater in the enjoyment than the promise, were exceeded by the delights of the workshop and laboratory. Every morning they watched for the moment when Sir Rupert moved towards the iron door: Avicena never watched more anxiously the famous library door that opened but once a year.

One morning Lucy observed a shallow drawer on the table between her father and Sir Rupert, and in this she saw some things which she thought might be very useful to Harry. The drawer contained many lenses of telescopes, and glasses of different sizes; some as large as that of Harry's camera obscura, which had been so unfortunately broken. It occurred to

Lucy that the loss might now be repaired. She waited till Sir Rupert was not busy, and then she asked him whether these glasses were very precious, too precious to part with, or whether she might beg one for Harry? Sir Rupert said that they were precious to him, because he was repeating some beautiful experiments of Dr. Brewster's and Mr. Herschel's; but he desired to know which Lucy wished for, as possibly that one might be spared.

She looked at the variety that lay before her, but which of them she wanted she could not tell. It was in vain to consult her father's eye: it never moved. Sir Rupert stood by with his good-natured smile, waiting her decision, but without giving any direction to her choice.

"If I could but recollect exactly the shape of the old glass in Harry's camera obscura," said Lucy. "What I want is a glass that magnifies; of that I am sure. These which are convex magnify, I believe. But," continued she, after having looked through several of them at a word which was written in small characters on the front of the drawer, "I find that some of these glasses magnify much more than others; and another thing I perceive, that, as I move each glass nearer or further, there is one particular distance at which the object appears distinct, but that the distances are quite different for different glasses. I recollect hearing you,

papa, telling Harry something about the *focal distance*. But I had better not say anything about that, as I do not understand it. I cannot tell which of these convex glasses will suit the camera obscura. However, I know the sort that I want should be convex."

"Very well, my dear," said Sir Rupert; "that is indeed all that you can tell, or that can be known without trial. You shall therefore take several of these convex lenses home with you, and Harry, by trial, can determine which will best answer your purpose."

Lucy was very much obliged to Sir Rupert, and delighted that through her means her brother's camera obscura was likely to be mended. But now that her curiosity was excited she wished to know more.

"Why, papa, do convex glasses magnify, and concave glasses diminish? I wish I knew. I wish I could understand the camera obscura. Mamma says that *camera oscura* is Italian for dark chamber."

"So far so good for the name," said her father; "but in this case the name tells us nothing of the nature of the thing."

"Yet, papa," said Lucy, "the first time you showed Harry and me a camera obscura, it was in a large dark room."

"Was it quite dark?" said her father.

“Not quite: the shutters were all closed, but there was a little hole in one of them, through which the rays of light came. We saw images of things very faintly upon a white sheet, which you had hung up opposite to the hole. What we saw was a sort of coloured shadowy picture of the landscape that was outside the window.”

“True,” said her father. “You observed that it was very faint and indistinct; did it remain so?”

“Oh no, papa; it became afterwards quite distinct, and almost as bright as the natural colours of the trees and grass, and we saw the figures of people as they walked past, in a field at a little distance from the window. I saw the colour of the women’s red cloaks and their faces quite plainly.”

“And what made this difference?” asked her father.

“It was a glass, a lens you called it, which you put into that hole in the window-shutter; just in the same way that the glass makes the landscape appear brighter on the paper, in Harry’s portable camera obscura.”

“Do you recollect how or why the lens produced this effect?” said her father.

“No, papa, not exactly. Harry explained to me afterwards something about it, but he could not tell me all; he said he did not know all then.”

“All! no, indeed,” said Harry; “not then, nor now.”

“Tell us all you remember, if you remember anything of what he did explain,” said her father.

“First he told me,” said Lucy, “why we see the shapes and colours of things. He said it was by the rays of light which come from them.”

“Come from them how?” said her father; “do you mean come out of them?”

“No, papa: but the rays of light go from the sun and strike upon objects, and then come from them to our eyes; or, as people express it, are *reflected* by those objects. Harry next told me something which I thought I understood at the time, but I am not sure that I can explain it.”

“Try,” said Sir Rupert.

“Harry showed me, in a book, an engraving of an eye, with lines representing the rays of light coming from all parts of an object, and meeting in an angle at the eye. He told me, that objects appear to us great or small, according to the size of that angle. Next he told me that our eye is in some way like a camera obscura. There is a little hole in the middle, through which the rays of light pass, as they passed through the little hole in the window-shutter into the dark room; and, after having crossed each other, they make a small picture of the object—I do not know where exactly, somewhere at the back of the eye, I be-

lieve, and upside down, as we saw the objects at first on the white sheet ; but in the eye these pictures must be extremely small. Something more Harry said about a part of the eye, which he called the *crystalline humour* ; and about the rays of light being bent as they pass through it, which I think he called being *refracted*, but which I did not understand at all."

Sir Rupert observed, that Lucy did well not to attempt to go farther than she knew clearly. 'There is hope, he said, of teaching anything to those who perceive and acknowledge when they do not clearly understand, and who are not satisfied with confused notions. Lucy was glad to hear Sir Rupert say to Harry that his little pupil did him credit ; and that she was not like little conceited misses, who, instead of wishing to learn in order to improve, desire only to display a smattering of knowledge.

"I am glad, my dear Lucy," added her father, "that your curiosity has been raised on these subjects. But we cannot at present assist you further. Only keep what you have steadily in your mind, and from that you may go on hereafter. With Harry's help, assisted by his favourite book, 'Scientific Dialogues,' and with your own attention, you may learn what you desire, but not all at once. You must not expect to learn Optics in one morning."

ELECTRICITY.

It was in the second week of their visit at Digby Castle, that one morning, as Harry and Lucy were left alone in the workshop, Harry whirring happily at the lathe, he felt Lucy suddenly touch his arm, and saw her looking up in his face, as if eager to say something. Rather reluctantly he slackened the whirring motion, and held back the tool.

“ Well, what do you want, my dear ? ”

“ I want you to come with me, I have made a discovery ! Follow me, Harry. ”

Harry laid down his tool and followed.

The workshop was a large irregular room, surrounded by shelves and drawers, and racks for tools, with various benches for carpenters and carvers, and for braziers and smiths ; three lathes were placed obliquely to the windows : in the middle of the room stood a circular saw machine, a lapidary's wheel, and a treadle blow-pipe ; and there were two flagged recesses, partly skreened off, and contrived for a camp forge and a small

casting furnace. There was another recess, elevated two or three steps above the floor, which contained some tall models, and behind these Lucy had discovered a door, which, being unlatched, she had pushed a little more open, and, now throwing it quite back, she said, "Look, Harry, at what is in that room." He looked in, and his eyes sparkled with joy.

"An electrical machine! a great battery!"

But with his foot on the threshold he stopped, and laying his hand on her arm said, "Do not go in—I do not know whether we may—I hope you have not been in there?"

"Oh no," said Lucy; "I would not without asking you."

"And I must not, without asking Sir Rupert. But, Lucy, when you first saw this, what did you think it was?"

"Oh! I knew directly that it was an electrical machine," said Lucy.

"You never saw one before, that I know of," said Harry. "I saw my uncle's, but you did not; it has been packed up ever since you came home from aunt Pierrepont's."

"Very true; but I have seen a print of one, with *electrical machine* written underneath; and I knew it directly from that; but I do not understand anything about it. As you saw my uncle's real machine, you can explain this to me. We

need not go in, Harry ; but, just as we stand here, you might show me the use of all the parts. First, tell me the use of that glass cylinder, which is something like a broad grindstone of glass, with a sort of a silk curtain hanging over it, and a long windlass handle ; and I see a chain, and—”

“ Yes, yes,” interrupted Harry, “ you see a great deal, of which I cannot explain to you the use.”

“ Why not ?” said Lucy.

“ You had better ask my father, or Sir Rupert,” said Harry.

“ So I will then,” said Lucy, “ for I am exceedingly curious about electricity ; I want to know all about the electrical kite, and the Leyden phial, and conductors and non-conductors, and electrics and non-electrics, and electrics per se.”

“ My dear Lucy,” cried Harry, “ how comes it that you know all these names, which you rattle off so finely ?”

“ I thought I should surprise you,” said Lucy, laughing.

“ I do not remember my father ever having talked of them to you,” said Harry, “ and I am sure I never did.”

“ No, you never did ; but I heard them at aunt Pierrepont’s, and I will tell you how it happened. It all began from a bit of wit. One

day, when there were a great many visitors, they were talking of a lady, who was very delicate—very nervous. Aunt Pierrepont advised her to try electricity, and a gentleman said he would answer for it that the Leyden phial would do her more good than any other phial in the world. My aunt smiled, and everybody smiled, and said he was witty. When the company had gone away, I asked my aunt what he meant? She said, ‘Only a *jeu de mots*, child, a pun.’ I asked what the Leyden phial was. She said it was rather a glass jar than a phial, and that electrical people, with their machines, contrived to fill or charge these jars with electricity. I asked what electricity was, but she had not time to tell me any more then. She was in a great hurry dressing.

“A few days afterwards some of the same people came again, and I heard that the nervous lady had received two or three *shocks*, and was wonderfully better—was quite set up again; and that electricity had cured some old Duke of a palsy in his arm: he had lost the use of it, but after one shock he could carry his glass to his mouth. Then every body said electricity was a wonderfully charming thing. But the week afterwards I heard that it was all a mistake; that the Duke’s arm had fallen back again, and that the nervous lady was as low as ever. Then they talked of

people that had been knocked down, and a Professor somebody, that had been killed formerly by electricity ; and an old lady said there should have been an act of parliament against it from the first. Then they talked of an electrical kite, and conductors, and lightning. I asked aunt Pierrepont again afterwards what was meant by an electrical kite and conductors. She told me that they were talking of the great Dr. Franklin's kite ; that he was a wonderful man, and had a wonderful kite, which brought lightning down from the clouds ; and that he was the inventor of conductors for houses and churches, and people in thunder storms ; but she said she could not explain more to me without being a professor of electricity, which she did not pretend to be. Now, Harry, as you say that you saw my uncle's electrical machine when I was away, you can explain it all to me."

" I am afraid not," said Harry ; " my uncle showed me several entertaining experiments, and I found in the closet within my room a most entertaining book on electricity, which I once sat up reading at night till my candle was burned out. There was an account of Otto Guerick's making and whirling a sulphur globe, and seeing, for the first time, sparks and flashes of light come from it in the dark. Then I got to the Leyden jar and the first electrical shock, and Franklin's

sending up his kite in the thunder storm. I was exceedingly happy that night ; but I believe my head was as much puzzled as yours was at aunt Pierrepont's. In the morning, when my mother found I had been up half the night, she was not pleased, and she made me promise not to do so again, and I never did ; I only got up as early as possible in the morning, and at every spare minute I was at the book in the closet. It was a great thick quarto. My father, however, stopped me before I had got half through it : he said it was not fit for me ; and it is true I did not understand half a quarter of it *then*, but I think I could *now*, and I wish I could see it again."

" But, Harry, why did you never tell me all this before?" asked Lucy ; " and why did you never mention to me the electrical machine, or Leyden jar, or even electricity?"

" I had my own reasons," said Harry. " One was, that you had not *come up* to electricity before we began our journey ; and indeed I was afraid of puzzling you, because I had been puzzled myself. I thought, too, that my father could tell you better whenever he pleased ; besides, I was not clear that he would like my going back to electricity then. But I dare say—I mean I hope—he will have no objection to it now, and that Sir Rupert will show us some experiments with this machine. I will go and ask

my father what he thinks about it," concluded Harry.

"Let us go directly then," said Lucy; "and, while you are asking papa, I will ask Sir Rupert if he will at least give me an electric shock."

"No, no; first let us be sure of my father," said Harry.

"I am sure he can have no objection," said Lucy; but, when they asked him about it, Lucy observed, that though he seemed unwilling to refuse their request, yet he looked somewhat sorry that it had been made—she did not know why. However, as to the essential point, he made no objection to her having a shock, and seeing the electric spark. He approved of their seeing some of the experiments mentioned in "Scientific Dialogues;" such as that of the pith balls, and of the poker, and that for which Harry specially pleaded, as he was sure it would divert Lucy—the experiment of the dancing paper figures. In short, their father said that he could not object to their seeing any electrical experiments which their friend Sir Rupert might think proper to show them. He could trust safely to his judgment in this and in everything that concerned Harry. To him they next went.

They found him in the library, settled in his arm-chair, reading, and looking so comfortable, that they did not like to disturb him. He was

indeed very happy, looking over a new pamphlet that interested him particularly—"An account of the late M. Guinand, and of the improvements made by him in the manufacture of flint glass for large telescopes." Harry and Lucy hesitating, went up to his chair, one to each elbow, and stood still, looking behind him at each other: they had a mind to retreat, without making known their request; but he looked up, and, smiling kindly, asked what they wanted. They told him; and when he found, that, notwithstanding their great desire to see the electrical machine, they had not been farther than the threshold of the room, he half rose from his chair; but, sitting down again, said, "I must finish this passage first. You may read it over my shoulder if you will. I cannot leave the story in this note half-told.

"While making this glass, M. Guinand never permitted any persons to be present except his wife and son, who assisted him. On these occasions they were generally secluded for many days and nights in his little laboratory; but when he had completed the operation, if the result was favourable, his friends and neighbours were admitted, and partook of some refreshment while offering their congratulations.

"A year or two before his death, M. Guinand tried an experiment on a larger scale than he had previously attempted. After much exertion, he had succeeded in producing a perfect object-glass of eighteen inches diameter. This glass had been put into the oven for the last time, in order to be gradually cooled; and the operation being now considered as completed the friends were, as usual, admitted. In the midst of their congratulations on this unprecedented success, after an unusually

long seclusion, the fire by some accident caught the roof of the building. On this alarming occasion, all present exerted themselves; and, after some trouble, the flames were extinguished; but not before some water had found its way into the oven, and destroyed its precious contents!"

"Ah poor M. Guinand!" cried Lucy.

"I hope he was more successful the next time," said Harry.

"He was nearly eighty years old, Harry," said Sir Rupert; "and the discouragement caused by this misfortune, and the great expense of those experiments, prevented his attempting any more on a similar scale before he died. I should have told you, that he was a poor watchmaker, in a country village in Switzerland, and that neither artists nor philosophers have ever succeeded in making glass equal to his."

Sir Rupert laid down the book with the air of a man who makes, but is willing to make, some sacrifice; and he attended his young friends to the electrical machine's room, as Lucy called it. She watched everything that was done. Harry went to the handle of the glass cylinder, and was going to turn it, but Sir Rupert stopped him, as he said that he had something to show Lucy first. He took up a glass tube, and rubbed it with his silk handkerchief; then holding it to Harry's head, Lucy saw the hair rise up, and bend towards it, and a feather on the table jumped up, and hung to it, as Sir Rupert held the glass tube near it.

“Just like what I have seen Harry do, with the glass stopper of the decanter, after dinner,” said Lucy. “And I have seen the same with a stick of sealing-wax, after it has been rubbed on a coat sleeve: and I remember, long ago, when we were little children, that we used to play with an amber egg of mamma’s; and that little bits of paper and feathers stuck to it just so.”

“True,” said Sir Rupert; “this property of attracting light bodies was observed in amber hundreds of years ago, by the ancients. The Latin name for amber, which is derived from the Greek, is *electrum*; thence our word electric, and electricity. All that was originally known about it, to the ancients, was this power of *attracting* light bodies; remember, I say *attracting*, Lucy. Did you observe anything more when you amused yourself with your amber egg, and the bits of paper and feathers?”

“Yes,” said Lucy, “we saw that after a time they would jump no more; they stood quite still, or they jumped back. I recollect, do not you, Harry? that they jumped forward and backward alternately.”

“That is,” said Sir Rupert, “that they were alternately *attracted* and *repelled*. I am glad that you observed, and have remembered that; you will now understand what I mean by the *repellent*, as well as the attractive, power of amber. But this re-

pellent power was never observed by the ancients nor known to the moderns, till about a hundred and fifty years ago, when it was thought a great discovery."

Lucy expressed some surprise that this had never been observed till so lately. Sir Rupert smiled, and said, "There is more to be seen and known about amber, with which perhaps you are not yet yourself acquainted. Did you ever see sparks, or a flash of light, come from amber after it has been rubbed? or did you ever hear a little crackling noise from it?"

"Never, sir," said Lucy.

"Nor was it likely that you should," said Sir Rupert; "because your amber egg, probably, was not a sufficiently large piece of that substance to produce the effect; but sparks have been seen from a large smooth piece of amber, and this observation created much surprise when first it was made; which was about the same time when its repellent power was, as I told you, discovered. Then the same properties were observed in jet, sulphur, resin, and glass; and still the same word, the same *name*, electricity, was used, to express the supposed cause of all these properties, in whatever substance they were found. To those substances in which, after using friction, these properties appeared, people gave the name of *electrics*, and to those, from which they could not be ob-

tained by any degree of rubbing, they gave the name of *non-electrics*. Amber, sealing-wax, and glass, for instance, are called electrics; this table, and the poker, for example, which you might rub with your hand for ever, without making them attract light bodies, and without obtaining from them any sparks, are called non-electrics. But take care, Lucy, that this name of non-electrics does not mislead you into taking it for granted that in non-electrics there is no electricity. When we come to your brother's favourite experiments, I shall show you, that the electric spark can be obtained from the poker by other means. Experiments tried by various people, at different times, in different countries, within the last sixty years, have ascertained, that not only in the poker and in the table, but in every substance in nature with which we are acquainted, solid or fluid, vegetable, animal, or mineral, in earth, air, and water, electricity is to be found, though in various proportions; and to be obtained, or made apparent to our senses, by different means. Remember, then, that *non-electrics* is only the name given to those bodies from which electricity cannot be had by friction: and, when I use the word electricity, I mean the supposed cause of the electrical properties of bodies. I must, however, observe, that as yet we are imperfectly acquainted with this science; and, of what is known, I know

but a small part, and of that I can explain very little to you. However, some of the principal facts I can tell you, and some of the principal *phenomena*, or appearances, I can show you. In the first place, before I say any more, we will show you some electric sparks; and you shall have an electric shock, which you are so curious to feel: Turn the handle of the glass cylinder, Harry."

As he worked it, Sir Rupert showed Lucy, that the glass cylinder, as it revolved, rubbed against the cushion, which was fixed so as to press hard against it. This cushion, he told her, is called *the rubber*. "Instead of rubbing with the silk handkerchief, as you saw me rub the glass tube, friction is in this manner more conveniently produced."

When this had been done sufficiently, Harry held his knuckles to a brass knob at the end of a tin cylinder, belonging to the machine, and which Sir Rupert told them was a conductor; immediately Lucy heard a slight crackling noise, and saw sparks come either from the brass to Harry's knuckles, or from Harry's knuckles to the brass—she did not know which, they passed so quickly. She followed his example; and, holding her knuckles to the brass knob, felt, with some surprise, the tingling sensation produced by the electric spark. Sir Rupert now told her to stand upon a little wooden stool, with thick glass legs, which he set on the floor near the machine. He desired

her to hold a chain, the other end of which was fastened to the conductor. After the handle of the glass cylinder had been again turned sufficiently, he told Lucy to give her hand to Harry. She exclaimed, that she felt the same tingling sensation she had perceived before, on touching the knob from the conductor.

“Yes,” said Sir Rupert, “you acted the part of a conductor, and Harry received an electric spark from you.”

He now told her to get off the stool; and said that he would give her an electric shock if she pleased, but warned her that perhaps she might not like it.

“Then give me only a little shock, sir, if you please. A *very* little shock, my dear sir, pray.”

Sir Rupert promised that it should be very slight. He desired her to hold in her left hand a chain, that touched the outside of a glass jar, which Sir Rupert told her was a Leyden phial. He put into her right hand a bit of brass wire, with which he told her to touch the brass knob fixed on the top of the jar. She did so, and at that instant she felt a shock. Slight as it was, it made Lucy start violently. At first she thought Harry had given her a blow on the elbow—then holding her elbow fast, she said that her curiosity was satisfied; and that, if this was the famous electrical shock, she never desired to feel it again.

Harry could not help laughing a little at her start and surprise, which seemed to him so much greater than the occasion deserved. Recovering, Lucy began to look a little ashamed. Sir Rupert observed, for her comfort, that great philosophers had been not a little frightened when first they felt the electric shock.

“Philosophers! sir,” said Harry; “how did they show that they were frightened?”

“By the strangely exaggerated accounts they gave of their sensations. One gentleman, after his first shock, wrote to a friend, that he felt himself so struck in his arms, breast, and shoulders. that he lost his breath; that he was two days before he recovered from the effects of the blow, and the terror; and that he would not take a second shock for the kingdom of France. Another, after trying the shock from the Leyden phial, said, his whole body had been affected with convulsions, and that he felt as if a heavy stone lay upon his head.’

Lucy hoped it would be remembered that her little start and first fright had all been over in a minute or less, “instead of lasting two days, Harry. But I suppose,” added she, “that their shocks must have been much greater than mine.”

Sir Rupert said, that the shocks they received could not have been much more violent than what she had felt.

Harry asked how he could be sure of that. Sir Rupert answered, that, as they had described the apparatus they used, an estimate could be formed of the utmost power of the shock which they could possibly have received. "They used only a small glass bowl," said he; "and not *coated* as the Leyden phial is now; they had no electrical battery, nor any means by which they could give a powerful shock."

Lucy observed, that Harry was perfectly satisfied by this answer, therefore she was sure that he understood it; but, for her part, she did not in the least comprehend what Sir Rupert meant. She was very desirous to know more; but so many questions occurred to her, that she could scarcely tell which to ask first. She wished to know why she had been made to stand upon a stool when she gave Harry the electric sparks; or why the stool, unlike all others, had legs of glass. She wished to know what was the cause of her receiving a shock from touching the knob on the Leyden jar with the wire. But her first question was, to Sir Rupert's surprise, "Has this electric shock been really of any use to sick people, or to men or women in palsies?"

Sir Rupert said he did not know. It had at first been thought to be of medical service; and it was said to have restored persons to the use of

their limbs ; but afterwards this had been doubted, and the apparent or transient advantage was ascribed to the effect on the imagination.

So far Lucy had not obtained much more actual knowledge than she had had before ; but the diffidence with which Sir Rupert spoke, gave her an idea of the great caution and modesty of real philosophers' speech ; so unlike the rash assertions of half-informed persons, or of conceited pretenders to science.

In compliance with Harry's request, Sir Rupert next showed Lucy some of the first experiments which Harry had seen at his uncle's ; which need not be detailed here, as an exact description of the experiment of the *pith balls*, and of the *poker*, and of the *dancing paper figures*, may be found in "Scientific Dialogues," illustrating the nature of electric attraction and repulsion. Lucy was amused with these experiments, but she could not take in all the explanations ; she became a little confused and puzzled about conductors and non-conductors ; which having candidly confessed, Sir Rupert advised her to stop, assuring her that he would, at another time, when her mind should be rested and refreshed, return to the subject ; and promising that he would reward her candour by doing his best to make it clear to her ; which, he added, he did not doubt but he should be able to accomplish,

if she would not either despair or be in a hurry—
if she would only have patience with herself and
with him, and allow to both a sufficient time.
“And now,” said he, “I shall be glad to return
to my pamphlet ; and you and your brother will
be glad, I think, to take a good run, or a walk.
Suppose we take the walk Lady Digby was
talking of, across the fields, through Copse-wood,
and over the ford, to Farmer Dobson’s. Ah ! ha !
you like that ; I never knew young people that
did not prefer a difficult to an easy—I will not
say a dirty to a clean—walk. Well, by the time
bonnets, and hats, and walking shoes are on, and
papa, and mamma, and Lady Digby, and all are
assembled in the hall, ready for a march, I have
a notion I shall have finished my pamphlet, and be
with you too.”

ELECTRICITY.

THIS walk was as rambling and as scrambling, with as many hedges and ditches to get over, and as many bad passes and unstable stepping-stones to cross, as hearts of youth could desire, or legs of age accomplish.

Farmer Dobson, the snuggest of yeomen, and the best of tenants, met the party at his outermost gate with a warm welcome for his landlord, and his landlord's friends, whomsoever they might be. His eye brightened when he saw young folks. "He had a power of his own, thank God for them," he said, as he opened wide the house door. "He loved young folks," he added; and requested that they would all be so agreeable as to come in and rest themselves after their long walk.

After they had sat for some minutes, and after orchard, and poultry-yard, and farm-yard had been all duly visited, and that it was time to think of returning home, Harry's and Lucy's satisfaction was completed, by the farmer's assuring them, that, if they had any misliking to go

back the same road they came, they might return quite a new way, "by passing through Topham Turnstile, and Higglesham Pike, down the fields of Red-deer manor, and so getting, by the short cut, straight up the back way to the castle."

Harry listened most attentively to these directions; but, as he did not know any one of the places named, it might have been even dinner time before they reached Digby Castle, had he persisted in acting as *avant-courier*; but he gave up the point at Higglesham Pike, whence, under the straight-forward guidance of Sir Rupert's cane, they reached home by the usual hour for luncheon.

Sir Rupert looked at his watch, and, finding that he had ample time, sat down to write some letters; telling Harry and Lucy, that when the clock should strike next, he would be ready for them at the electrical machine.

Punctual as the clock, Harry and Lucy were opposite to the electrical machine; and Sir Rupert, equally punctual, shut the door after him ere the clock had done striking.

"Lucy, my dear," said Sir Rupert, "I hope you have put out of your head whatever it was that puzzled you about conductors. The name of conductors is given to all substances which conduct electricity from one body to another. Those

which will not do this we call non-conductors. Is this clear to you?"

"Quite clear," said Lucy. "I do not know what puzzled me before; but I believe it was that non-conductors are also sometimes called electrics."

"Yes, it has been found that all originally electric substances are also non-conductors. Of electrics and conductors lists have been made, and you may look at them at your leisure. It is enough for our present purpose to tell you that earth and water are conductors, and so are all the metals;—metallic conductors are the best. This brass chain is one; so is that iron rod, and so is this tin tube.

Lucy saw, and understood this, and now hoped they might go on to the Leyden jar.

"My dear Lucy," said Sir Rupert, "your brother tells me you are fond of French proverbs: did you ever hear 'Il faut reculer pour mieux sauter?' I must therefore go back, if you please, to the reign of Charles the Second, where I left off, just before Harry persuaded me to show you the experiment of the poker. Many of the members of the Royal Society, which was at that time first established, were at work on electrical experiments. Among others was a philosopher, with whose name you are perhaps acquainted—Boyle."

Lucy asked Harry if this was *his* Boyle, the great vacuum-man?

"Yes," answered Harry.

"He was one of the first persons who had a glimpse of electric light," continued Sir Rupert, "which he first saw from a diamond."

"A diamond, sir!" said Lucy; "I thought you told us it was first seen in amber."

"I said it was seen in amber, but I did not tell you it was first seen in amber," said Sir Rupert; "I should not have mentioned that out of its order in point of time. Boyle is supposed to have been one of the first discoverers of electric light. He noticed it as he was rubbing a diamond in the dark."

"But was Boyle the *first* person who made this discovery?" said Harry, doubtingly.

"Perhaps," said Sir Rupert, smiling, "you claim the honour of it for the children in the Arabian tale, who wakened their mother by quarrelling for the diamond that gave light in the dark?"

Harry and Lucy both smiled.

"But seriously, sir," said Harry, "did not Otto Guerick see sparks and flashes from his whirling globe of sulphur?"

"Sparks and flashes he certainly saw from his sulphur globe: but whether before Boyle saw the flash from his diamond is to this hour a

disputed point; and I advise our avoiding all disputes."

"I am glad of it," said Lucy, "they hinder one from getting on."

"But," said Harry, "I thought it was but justice to settle this, and to give Boyle the honour of the discovery, if it was really his, especially as I love Otto so much."

"Very right, my honourable friend," said Sir Rupert, "preserve that spirit of justice all your life: but, for the present, consider, that if we were to attempt to settle all the disputes about priority of discoveries in electricity, we might stand here all day, and be found in the dark at last. Now let us go on, and keep safe in the use of the impersonal pronoun *it*. It was discovered. I assure you, Harry, I am willing to give all due honour to your favourite Otto Guerick for the ingenuity of his whirling globe of sulphur to excite friction, by means of which he made the great discovery of electric repulsion; but, Harry, it is remarkable that he missed another discovery, which was absolutely under his hand."

"Under his hand! What? How, sir?" cried Harry.

"You recollect, or you forget, perhaps," continued Sir Rupert, "how he made his globe. He melted the sulphur in a hollow globe of glass, and then broke the glass to get out his sulphur

ball, little imagining that the glass which he broke, and threw away, was a more highly electric substance, and would have answered his purpose better than that upon which he was intent."

"That is curious ! But he could not tell that beforehand," said Harry.

"No, but he might have tried ; he need not have taken it for granted that glass is not electric."

Harry asked if Sir Isaac Newton, who lived at the same time as Boyle, and was one of the early members of the Royal Society, had made any discovery in electricity ?

"Yes," said Sir Rupert, "he made one, and but one, discovery of importance. As he was rubbing a glass lens, he observed that it became electric on the side of the glass opposite to that on which it was rubbed. This circumstance I did not mention to you, because I cannot explain its consequence without entering into explanations that would not suit you at present. We will go on where we were. After the flashes of light from the sulphur globe, there was darkness on the subject of electricity for some time. Public curiosity, which had been suddenly excited, as suddenly grew tired, and fell asleep in England, from the reign of Charles the Second till the reign of Queen Anne ; when it was first wakened, I think, by Mr. Hawksbee, who set to work by

whirling a globe of glass. He also provided himself with a globe of sulphur, and one of sealing-wax, inclosing another of wood, and he had a fourth made of rosin; with all these he tried experiments, the chief result of which was the discovery that of all known substances glass is the most electric. This proved of the greatest convenience, as well as importance to science. As glass can be so easily moulded, and blown into different forms, it was best adapted to the use of every experimenter, and from that time became the principal part of every electrical apparatus, in the form of tubes, globes, cylinders, and circular plates.

“ Still philosophers were as much puzzled about conductors and non-conductors as you were this morning, Lucy. It was only by experiments that they were enabled to settle which were which; and many were tried at this period by two friends, Mr. Wheeler and Mr. Gray, who, in conjunction with one another, laboured to ascertain how far they could communicate electricity—to what height and to what distance. From balconies they let down long hollow canes, and in great barns they stretched wooden rods and strings of packthread, sometimes supported by others of silk. With considerable difficulty they conveyed electricity, by these lines of communication, about seven hundred feet. But they were, as it seemed,

still much in doubt which substances served their purposes, and which did not. Besides their imperfect knowledge of conductors, another difficulty occurred: they found, that the electricity which they communicated to bodies, or which existed in electrics, was dissipated after a short time. It was discovered that these bodies parted with their electricity to other surrounding objects; to the earth and to the air. They perceived that their labour must be vain, if, as fast as they poured the electric fluid into the substances on which they were trying experiments, it was lost before they accomplished their object of conveying it to a distance.

“ Some new contrivances were required, to counteract and remedy this inconvenience. They separated, as well as they could, the substances on which they were operating from all others; and hung them from lines of dry cotton and silk, finding that these were not conductors. Some of their experiments were tried upon living creatures. They suspended a child by silken lines, and tried to communicate electricity to him. They electrified him as you were electrified this morning, while standing on the glass-legged stool, and only felt the tingling sensation you described. But the electric *shock* had never yet been felt; and, though sparks had been communicated to

the human body, no one at this time suspected that electricity existed *in* it.

“ Public attention in England was fixed upon these experiments by the lectures of one, whose name, Harry, I think you know—a great mechanic—Dr. Desaguliers. But it was in France that electricity now became particularly popular. This was in the reign of Louis the Fifteenth, who was contemporary, you know, with our George the Second. The Abbé Nollet, a very ingenious and celebrated man, began by repeating the English experiments, along with his friend, M. du Fay, whose name is less known, I cannot tell why. By using *wet* packthread for their line of communication, they succeeded in conducting electricity along the walks of a garden, above a thousand yards, which was then considered wonderful. At a famous experiment, however, exhibited at Shooter’s Hill, it has since been conveyed above four miles. I should not have told you this out of due order, but for the honour of old England, Harry, I could not resist. I beg the Abbé Nollet’s pardon. He succeeded, as I told you, in communicating electricity above a thousand yards, by means of a line of *wet* packthread. The general observation had long been made, by Gray and others, that moisture assisted in the communication of electricity. Yet it had never

occurred to them that water was a conductor. Now it was ascertained that water is a good conductor.

“The Abbé Nollet and his friend M. du Fay repeated Gray’s experiment of suspending living creatures by lines of silk, and setting them on cakes of rosin or stools of glass as non-conductors, for the purpose of preventing the electricity communicated to them from being carried down to the earth. This was called *insulating* them; placing them, as it were, in an island. M. du Fay had himself suspended in lines of silk and electrified, and delighted he was; but infinitely more so, when, to his surprise, he saw what no one had ever before seen, a spark of electric fire drawn from the human body. The Abbé Nollet declared he never could forget the astonishment he felt, when first he saw a spark of electric fire come from a human creature.

“This experiment, and others upon electric attraction and repulsion, were immediately repeated before the French Academy of Sciences. Curiosity was raised among all ranks in Paris, and crowds of people flocked to see them exhibited. As it had been discovered that electricity could be conveyed from one person, as well as from one inanimate substance, to another, people stood hand in hand in circles to be electrified, and the novelty and surprise of the effect were entertaining to all.”

“ Did they feel a shock, such as I had this morning?” asked Lucy.

“ No, not a *shock*,” said Sir Rupert ; “ only that slighter sensation, which was attended by the snapping noise that you heard, when the sparks came from your hand to the brass knob, and from the brass knob to your hand. As to the electric shock, that was not learnt till the discovery of the Leyden phial. But the Abbé Nollet’s experiments were sufficiently wonderful at that time to produce general admiration. Franklin was then, as well as I recollect, at Paris, and saw Nollet’s experiments. When he returned to America, his powerful mind set to work on the subject, with all the requisites that could *promise*—I might almost say, humanly speaking, *ensure* success—acute observation, indefatigable patience, and great caution in trying experiments, with the habits of close reasoning and active invention. But I must not let enthusiasm for Franklin draw me out of my course. It is not yet time to follow him to the country of which he is the glory ; first, justice calls me to Holland. Now, Lucy, we come to the Leyden jar ; but for one moment more let me try your patience. It is very difficult to be patient, I know, when just in sight of your object.”

Lucy’s eye glanced at the tray full of jars, which she saw near the electrical machine before

her, but she forbore to ask any question. She stood an edifying example of patience, and the admiration of Harry.

“ I must say a word or two to you, my patient Lucy,” continued Sir Rupert, “ about this electrical machine. You do not imagine that it came into the world as you now see it, ready armed with conductors, and provided with all that could fit it for the service of electrical philosophers. Far from it : this machine, such as you now see it, is the result of the combined observation, ingenuity, and labour of a succession of philosophers, who have been at work for above one hundred and fifty years, trying experiments on electricity : and, in fact, this machine contains the evidence and register of their progress. When the name and the knowledge of electricity were confined to one substance, no apparatus was necessary ; the man rubbed his piece of amber with his hand, or on the sleeve of his coat, and his business was done. With this he could see and show all the wonders of which he knew the existence. But when knowledge increased, and when the lists of electric substances and of conductors swelled and lengthened, when experiments were to be tried with globes of glass and conductors of metal, with balls and points, and lines of silk—all these things were by degrees arranged into the form you see. A cylinder of glass is used in this machine, instead of a

globe ; it is found that this shape is preferable. Lucy, do you now perceive the use of the glass legs to the stool on which we placed you when you were electrified, and when you gave a spark to Harry ?”

Lucy said she thought that they were to prevent the electricity from being carried down to the earth, glass being a non-conductor. She supposed that she was put upon it for the same reason that the man or boy to be electrified was set upon the cake of rosin.

“ You reward me for my pains,” said Sir Rupert ; “ or rather you complete my pleasure in teaching you, Lucy ; for you show me that you have been attending, and that you have perfectly understood all that I have been saying.”

Harry looked far prouder than if praised himself.

“ Now I hope the Leyden jar will not disappoint you after all,” continued Sir Rupert. “ It was so called simply because it was invented at Leyden, and by means of a phial or small bottle. Its properties were discovered by a Dutchman of the name of Muschenbroek, about eighty years ago ; and in this manner. Having observed, like all those who had tried experiments on the subject, that electrified bodies, when exposed to the atmosphere, soon lose their electricity, and were capable of retaining but a small portion, he de-

terminated to try whether he could not prevent this loss, and whether he could accumulate a greater quantity, by *surrounding* the substance to which electricity was to be communicated by some non-conductor, instead of suspending it in the air, as formerly, by silk lines, or supporting it upon rosin or glass. The experiment could be simply tried with water and glass: he chose water, as being a powerful conductor, and glass, as it is the most perfect electric and non-conductor. Electricity was to be communicated from a metal conductor to the water in a glass phial. When the water had received as much electricity as it was supposed that it could contain, the person who had the phial in one hand was going with his other hand to disengage an iron wire, which communicated from the water to the principal conductor. But the moment he touched that wire he was surprised by a sudden shock in his arms and breast—the first ever felt from any electric machine, and of which such exaggerated descriptions were given, as I repeated to you this morning.”

“But how did it happen?” said Harry; “what was the cause of the shock, sir?”

“That,” said Sir Rupert, “I dare not even attempt to explain to you. You must be contented at present with the simple fact. This astonishing experiment gave sudden celebrity and popularity to electricity; accounts of it were written to every

country where science could penetrate. All persons were eager to feel the *shock*, notwithstanding the terrible account of it. Numbers of people made their livelihood by going about and exhibiting it in every part of Europe. Philosophers all went to work to repeat the experiment, and to try to account for what had happened. Many theories or suppositions were formed, but as Dr. Priestley says, in his account of it, the circumstances attending it remain in many respects inexplicable, and the experiment is to this day justly viewed with astonishment by the most profound electricians. Since the first discovery of the Leyden phial, its power has been increased by coating it to a certain height with tin-foil, both withinside and without; and it soon became an essential part of an electrical apparatus. An electrical battery, such as you see in the machine before you, or as you, Lucy, called it, a tray full of jars, is formed of several Leyden jars, connected together by conductors, so as to increase prodigiously the power and accumulation of electricity.

“To console you, Harry, for not attempting to explain what I cannot explain, I will describe what I can describe—the electric kite of Franklin. His delight and astonishment were great on hearing of the Leyden jar. He repeated the experiment: his ardour increased in pursuit of electrical discovery, and a most brilliant discovery soon rewarded

his genius and perseverance. Some points in which the flash and sound of electricity seemed to resemble thunder and lightning, had early occurred to him, and he now resolved to examine the truth of his conjecture by experiments. But, Harry, it is very important to inform you, that several other people had long before been on the brink of this discovery—had actually touched it, but had let it go. The man who first saw the electric light, a hundred and fifty years before this time, said and wrote, that the crackling noise and flash reminded him of thunder and lightning; but he pursued the idea no further. At a more advanced period of our electrical knowledge, their identity with thunder and lightning was again suggested by others. But Franklin, when once the happy thought occurred to him, pursued it unremittingly, and has left us what is almost as valuable as his discovery, an account of the reasoning by which his mind arrived at that grand truth. This, Harry, you will be curious to know hereafter.”

“I am curious to know it now, sir,” cried Harry; “will you tell it me?”

“No, that is not in my promise,” said Sir Rupert; “that would lead me too far away from my present engagement to Lucy. This much to please you I will mention, that Franklin argued thus with himself: If lightning be the same as

electricity, it will obey the same laws: it can be managed by the same means. If there be electric fire in a thunder-cloud, it may be attracted and brought down to the earth by some of those substances which are found to conduct it. He therefore made a kite of a silk handkerchief stretched on a light cross of wood, with an iron wire pointing upwards. The string was of twine; to the end of the string he tied a silk ribbon, and where the silk and twine joined he fastened a key. Lucy, can you tell me why he tied a silk ribbon below the key? Why did not he hold the kite by the key?"

"Because the key would be a conductor, and bring the lightning down to his hand, but the ribbon would stop it; because silk, as you told me, is a non-conductor."

"Very true," said Sir Rupert; "but, Harry, why did not he hold the kite by the twine?"

"Because, perhaps, he thought, sir," said Harry, "that if it rained, and if the twine should be wet in the thunder shower, it would, like the wet pack-thread used formerly, conduct the lightning down to his hand."

"Just so, Harry; all that he had foreseen happened, and all the precautions he had taken succeeded in preventing danger. His kite went up: as soon as a thunder-cloud came over it, the elec-

trical matter in the cloud was attracted by the iron wire conductor. It rained, the string was wet, the lightning ran along the string to the key, and there was stopped from going on to his hand by the silk ribbon."

"Oh! I am glad of it!" cried Lucy; "I am glad he succeeded—he deserved success."

"He afterwards applied this discovery to a useful purpose. Upon the same principle as that of his electric kite, he attached rods or chains of iron to buildings, and connecting them with the earth, the electric fire of the clouds was safely conducted there, and away from all it could injure. And here, at this excellent application of the discovery, I will leave you, my young friends. I cannot leave you with an impression more favourable to science."

"But, sir," said Harry, "could not you go on—I do not say now, but another day—could not you go on to the discoveries made since that time, and then to Galvanism and Magnetism?"

"No, Harry, I cannot—I will not," said Sir Rupert.

"But, Sir Rupert, could not you at least be so good as to explain to Lucy what I now recollect was a thing that puzzled me, the difference between *positive* and *negative* electricity. You never mentioned them; is it not necessary to understand what they mean?"

"Necessary to the knowledge of the science

of electricity certainly," said Sir Rupert; "but you know I did not undertake to teach you that."

"No, but I wish you would," said both Harry and Lucy.

"Come with me, and I will show you how impossible it is for me to fulfil your wish."

They followed, and he led them to the library. Their father, who was writing a letter, looked up as they came in, and saw Sir Rupert go to one of the book-cases, and take down two volumes, one of them a very thick quarto; these he laid on the library table before Harry and Lucy.

"To give some idea," said he, "of the quantity that has been written, and may be read and learned upon the subject of electricity, look at these volumes."

Harry's father looked at the titles.

"Oh, Sir Rupert, what have you done?" It is all over with Harry now, thought he, and sighed.

One of these volumes, the largest of them, was the very book which Harry had sat up a night to read. His eyes grew round the moment he espied it again, and, pouncing upon it, he neither saw nor heard anything more; not even his father's sigh.

Poor innocent Sir Rupert, equally unconscious of the delight and of the alarm he had given, to son and father, stood considering Lucy, with

whom also, as his ill fate would have it, his intended good lesson was not operating as he had designed. He had expected that Lucy would have been completely awed by the sight of the bulk of these volumes, and that by turning over the pages and the titles he could have soon proved to her how vain an attempt it must be for her to master such a voluminous subject. But it chanced that the lesser of the quartos was left to her, and immediately turning to its excellent index she found, "*An Electrical Party of Pleasure*," and a bill of fare that quickened her appetite amazingly, as she read—

"Electrical eel—electrical dinner—dinner of electricians—the turkey to be killed by an electrical shock, roasted by an electrical jack, before a fire kindled by an electric spark; the healths of all the company to be drank in electrified bumpers, under the discharge of an electrical battery."

"Very good philosophical nonsense, after all," said Sir Rupert, addressing himself to Harry's father, and not clearly understanding the cause of the uneasiness visible in his countenance. "Franklin well knew how to catch and fix the attention of young and old. There is no harm, is there, in her amusing herself with these things? She will soon find what she can understand, and what she cannot."

Her father assented ; but still the uneasiness in his countenance continuing, Sir Rupert added,

“ She is too sensible a girl to pretend to know what she does not know. She will never, I will venture to say, turn out one of those mere index hunters, whom some witty poet describes as ‘ catching the eel of science by the tail.’ But let young people catch the eel any way they can, so that they do but catch it.”

“ But we must be sure that they can hold it afterwards,” said her father.

“ True, true ; you are right and I was wrong — misled by my own simile, as reasoners fond of similes usually are,” said the candid Sir Rupert.

“ Harry !” said his father. Harry started.

“ I am sorry to see you at that book again.”

“ I am sorry that you are sorry, father,” said Harry, in some confusion.

“ You recollect what happened last year, Harry. You lost a whole month of your life, trying to make an electrical machine. I found your head so full of that book that I could get nothing else into it. Like an intellectual glutton, you had devoured till your mind had an indigestion, and absolutely could not stir.”

“ But I am a year older now, and a year wiser, I hope. You shall see how moderate I will be, if you will let me finish the book while I

am here. I will read it only one hour before breakfast ; and I really think I deserve that, father ; because, from the time you stopped me, I not only put it quite out of my head, but never mentioned it or electricity even to Lucy, till just now, when she showed me the electrical machine ; and then, indeed, it all came out."

" And it was all my fault," said Lucy.

" There is no fault in the case, my dear children," said their father. " Let us consider only what is best for you."

Harry closed his book, and, without uttering a word, returned it to Sir Rupert with " proud submission and dignified humility."

" I will give you my reasons as well as my advice, Harry," said his father, " for you are a reasonable creature ; and, wherever practicable, opinion should be supported by reasons, even from age to youth—even from a father to his son.

" I advise you, my dear son, to defer the pleasure of reading that entertaining book, and to reserve electricity altogether as a study, for a later period of your life ; because, in the first place, you have not time for it at present. You have many things more necessary to learn, more essential to the progress of your education ; in other words, essential to your acquiring that strength of understanding which can alone enable you to ad-

vance in knowledge hereafter. Neither boy nor man can embrace all the sciences at once. You are now learning those which are in a state of certainty, as far as human certainty goes; electricity, as a science, is in but an imperfect state. Since that book has been written, many discoveries have been made. New and vast views have been opened, of which at this moment none can even guess the termination. Many of the theories adopted as certain when that book was published, are now considered as obsolete, or, what is worse, unfounded."

"I beg your pardon for interrupting you, father," said Harry; "but the facts proved by experiments must remain the same, must not they, as far as they go?"

"True, Harry," replied his father; "as far as they go they remain the same; but the explanations of the phenomena, the reasonings on these experiments, and the conclusions formed from them, have varied in consequence of later information, and will vary from day to day, as fresh experiments and newer discoveries are made; so that supposing, Harry, you gave up everything else, in order to make yourself master of all the knowledge in this thick quarto, and granting that you accomplished this object, in what condition would you be? Not up to the modern state of the science, far from it; on the contrary, not in nearly so good

a condition for advancing as you are in at this moment; because you would have much to unlearn, and false notions and favourite prepossessions to lay aside. If you postpone reading this work for some years, the science will probably have taken a more stable form; then go on with electricity if you will. When you are able to distinguish truth from error, you will read this book with infinite advantage, and you will find it not only an excellent history of this particular science, but an admirable view of the progress of the human mind in making discoveries, and an invaluable lesson in the errors as well as the efforts of the human understanding. Have I satisfied you, Harry?"

"Satisfied! Oh, thank you, my dear father," said Harry.

PANTOMIMES.

THERE were certain nephews and nieces of Lady Digby's, whom Sir Rupert had once mentioned, regretting that they could not be at Digby Castle while Harry and Lucy were there. By some new arrangement of journeying, it was, however, discovered to be quite possible that they could now come to spend three whole days. When this was announced, Harry, to say the truth, felt more sorry than glad. He knew that the pleasures of the workshop and of the laboratory must be given up, and that they could not hope to have so much of Sir Rupert's conversation and instruction : besides, Harry was not naturally inclined to like strangers. Nevertheless, when they arrived, he liked them tolerably well, even the first evening. The party consisted of a father and mother, two daughters, and three sons. Of the boys, one was about Harry's age, the others younger. The young ladies were older than Lucy, almost grown up, and quite unaffected, good-humoured, and gay. When they went out to walk all together, they became well acquainted, and soon joined in

various amusements. As they were standing on the bowling-green, one of the boys observed that there were bowls in the alcove; his brothers ran for them, and all began to play at bowls. Its being rather an old-fashioned game was no objection; but the young ladies found the bowls rather heavy and cumbersome. On hearing this, Lady Digby suddenly recollected a ball of a new sort which she had brought from London, thinking it would be agreeable to some of her young friends. She went for it, and returned bearing in her hand a ball as large as Lucy's head, and of a beautiful light brown colour. It looked nearly transparent: it felt light as a feather. Sir Rupert bid Harry try if it would bound well. Harry struck it on the ground, and it rebounded high over the heads of the admiring circle, higher, as all declared, than ever ball was seen to bound before. All inquired eagerly, "Of what is it made?" All examined it, and guessed, but none guessed rightly. Sir Rupert told them that it was made of *caoutchouc*, which is so very elastic, that it may be blown out to many times its original size by forcing air into it.

"This ball then is filled with nothing but air, so that it is no wonder that it should be light," said Lucy.

Sir Rupert said that he had seen such balls in a shop, the day before he left town. They were

then quite new things. While the shopman was showing him how well one of them rebounded, it suddenly disappeared, and for some time could nowhere be found; at last it was discovered in a corner, a shrunk, shrivelled bag. It had struck upon a nail. A young person who was in the shop suggested that a covering of leather might preserve such balls from similar disasters in future. Sir Rupert did not know whether this advice had been followed, but he had little doubt that the ball would become popular. It was much admired by the present company for its elasticity, its beauty, and its safety; for with this they could play even in the house, without danger to windows or to looking-glasses.

They played with their new ball till by chance it fell among the branches of a tree. One of the young Mallories (Lady Digby's nephews) climbed the tree with great agility to bring it down. Some one said he was as active as a harlequin, and this led another to mention a harlequin entertainment he had lately seen, and from harlequin entertainments they talked of pantomimes, and it was proposed that they should act pantomimes that evening.

Harry and Lucy had never tried, but they were very willing to take any part proposed to them. They understood that the thing to be done was to represent by action, without speaking, any well-

known story, or character, or event in fiction, poetry, or history. After having assisted in some subordinate parts, their companions begged Harry and Lucy to choose some subjects for themselves. They proposed several; but from want of experience their choice was seldom happy.

Harry's first thought was William Tell, and the tyrant who ordered him to shoot at an apple, placed on his son's head. Harry was provided with a bow and arrows for William Tell. A tyrant was easily found; but who could stand for the child? Harry stuffed a little coat with straw, and Lucy made it a head, and put a hat on, and the apple was set on the hat. But Harry could not hit the apple, and the stuffed child tumbled on its nose, and when its hat fell off there was an end of William Tell.

Miss Mallory recommended the favourite stories in English history of Alfred disguised as a minstrel in the Danish camp, and of Alfred in the old woman's cottage. The new performers had good success. Harry, in the character of Alfred, wasted and burned the cakes with well-acted carelessness; and Lucy's box on the ear was capital. But these had been acted rather too often at Digby Castle to have the charm of novelty.

Lucy was resolved now to choose quite a new subject, and she thought of one from the New Arabian Tales. "Xailoun, surnamed the *Silly*,"

who was desired by his wife to change himself, and who never could find out what she meant. But nobody was acquainted with Xailoun or his follies. This was as much too new as the other subjects were too old.

Lucy next proposed, surely an unexceptionable scene, the parting of Hector and Andromache; Harry to be Hector, and Miss Mallory Andromache; "for she acts so well," said Lucy, "and I act so ill; but I think I could be the nurse." So it was arranged. Hector providing himself with a dazzling helm and nodding crest, to scare the young Astyanax; but unluckily, though they had chosen the least of the children from the porter's lodge, the child was too old to cling crying to the nurse's breast; obviously too large for nurse, mother, or father. The young Astyanax, besides, was terribly awkward; he would keep his thumb in his mouth, notwithstanding all his nurse could do to hold down his hand. Astyanax began to kick, and pushed his father from him in the midst of Andromache's distress. There was no standing the contrast. Hector and Andromache parted more abruptly than they had intended, and left the nurse to get off Astyanax as she could.

They were more successful in Ulysses and Euryclea. Lucy was admirable as Euryclea, and started finely at the sight of the scar. But this was too short; one start is not enough to

make a good pantomime. Harry proposed to lengthen it by placing Penelope at her loom, and shooting the suitors at their riotous feast. A feast is always a good thing for acting, as Frederick Mallory observed ; and his eldest sister, who was tall and graceful, would act Penelope beautifully. Her mother's shawl and veil, happily disposed, converted her into the Queen of Ithaca in a trice ; and, when Harry had taught her to weave and unweave, she bent over her loom with dignity, and pensive sat and mourned, by lamp-light, in the great hall. But a Penelope was nothing without suitors. Vain was the bow of Ulysses, for he had nobody to shoot. Only three suitors could be had, the three young Mallories, and they were dressing for the Forty Thieves. An experienced manager, however, suggesting that the suitors might be *supposed* to be feasting in the dining-room, he left the door half open between them and the queen. Ulysses looked in, and frowned, and twanged his bow at them through the door-way, with fine tragic effect.

Harry and Lucy found that, in the pantomimic art, as in all others, actual experiment is necessary in the selection of subjects, as well as in the mode of execution. One general remark was made, that the Caliph Haroun Alraschid, and his Vizier Giafar, were constantly well received. So were Zobeïde and her favourite, with the long unpro-

nounceable name,—Nouzhatoul Aouadat. There was something in the turban, and in the eastern costume, which was becoming; this prepossessed the spectators favourably at first sight; besides, the effect of the complete disguise upon the actors themselves gave them courage. The only part in which Harry felt at ease was in Giafar; his painted and bearded face was as good as a mask, behind which his own was safely concealed. When thus thoroughly incognito, the little actors can forget themselves, and be what they represent.

It is peculiarly difficult to act any part approaching to our own character, or touching upon our real tastes. Of this truth Lucy was made sensible by a mistake she fell into in the choice of a character for Harry. She persuaded him to act Archimedes. It did not suit him at all. Lucy acted the soldier bravely, with a drawn sword brandished high over his head. But Harry was a very awkward Archimedes at his problem; and this was the more mortifying, because there was not time to prepare another part for him. It was the last night, and too late to act anything else.

It was disagreeable to end with a failure, but Harry and Lucy showed so much good humour upon this, as well as upon many other occasions, during these plays, that, though they failed in most of their attempts at acting, they succeeded in making themselves liked by their young com-

panions. The good nature, and perfect freedom from little jealousies, displayed by the whole party, made them all happy together; and Harry and Lucy agreed, on the morning when their young friends were leaving them, that the visit had been very pleasant, though it had interrupted them in their own little pursuits. Such interruptions are good for us all. They prevent us from becoming selfish; they teach us to turn readily, and in an obliging manner, from one thing to another; and further show us, that there are many ways of employing the time, and of occupying the mind, different from our own, and yet which tend to the same ends.

BALLOON.

THE carriage drove from the door; and, by the time the sound of the wheels was out of hearing, Harry and Lucy, who were standing in the porch, heard in the hall the short little bark of a dog, and then that sort of noise which is made by a provoked cat, which we would fain call by a more genteel name than *spitting*, if we could find any that would better suit the action. The short bark they knew to be that of Sir Rupert's own little terrier, Dusty-foot; the other sound they suspected to come from the housekeeper's great Persian cat Selima, who was rather a spiteful creature.

"Oh the ball! the ball, Harry!" cried Lucy.

Harry ran to the rescue. At that instant there was silence. The dog had the great ball between his paws; the cat, with her back up, hair erect, tail stiff, eyes glaring, stood and looked, while Harry, patting the dog's head with one hand, drew away the ball with the other; but with a sudden spring the cat darted forward, and set her paw upon it. Harry, seizing hold of her leg, snook it, and loosened the claw; she gave him one scratch, and seemed to meditate another

Lucy advanced, unfurled her parasol full in the creature's face, and straight Selima fled to her regions below. No shame for cat to fly before that terror which has ere now scared the most furious of the tiger race.

"The ball is safe," said Harry, after careful examination: "Selima's vile claws have not gone through. It has had a narrow escape. In future we will put it in a place of safety."

While Harry looked round, to decide where that place of safety should be, Lucy patted Dusty-foot, who stood wagging his tail, apparently much satisfied with himself for having so well defended his master's property: but he suddenly sprung from beneath her hands, and darting to an open door, ran to meet his master. Sir Rupert had the key of the laboratory in his hand, which he held up to Harry and Lucy, and they followed him with the speed of Dusty-foot.

Harry was going to inquire where they should secure the ball; but Sir Rupert interrupted him by asking,

"What is the matter with that bleeding hand of yours, which is tied up in your handkerchief?"

"Only a scratch, sir," answered Harry, in his cut-the-matter-short tone. Lucy desired no better than to fight the battle o'er again.

"But after all, Harry," said Lucy, "I wish you would let me put some court plaster on the

scratch." She had one precious bit in her pocket-book, which she produced. No; Harry would not hear of it. Court plaster would never stick upon him, he said.

"A man must never mind a scratch; that I have known ever since I was four years old," said Sir Rupert. "Nevertheless, since I have come to man's estate, I have found that scratches are troublesome when they fester; and if you will take my advice, Harry, accept your sister's offer. You will be able to do nothing in the laboratory with your hand muffled up in that fashion."

This was an unanswerable argument, whereupon Harry surrendered his hand: but he persisted in his objections to court plaster; goldbeater's skin was the only thing which would stick on his wounds. Sir Rupert recollected that in Edward's press some might be found. Edward's press, as everybody knows, was in the laboratory. Sir Rupert unlocked it, observing, that, as in his son's absence, he was sole guardian and administrator of his effects, he had no scruples in administering this.

Lucy opened her eyes at the sight of a piece of goldbeater's skin, a foot wide, and a quarter of a yard long. She cut off the strip she wanted, inquiring at the same time what goldbeater's skin was. Sir Rupert told her that this skin, so called from its being used by goldbeaters, was the inner mem-

brane of one of the intestines of an ox, narrow slips of which are joined, simply by moistening and laying the edges over each other. He added, that the gold was first flattened between steel rollers; then beaten out between leaves of parchment, with broad heavy hammers; and lastly reduced to the proper degree of thinness between pieces of this membrane, by beating them with lighter hammers.

Lucy next asked why Edward had such a store of this among his valuables? Did he cut his fingers so very often as to need such a provision?

Sir Rupert told her that Edward had it for a very different purpose; for mending balloons. At the word *balloon*, delight and eager curiosity glowed in Harry's and in Lucy's faces.

"Oh, sir!" cried Harry, "did he ever send up a balloon?"

"Only some very small ones, with which we were trying some experiments."

"Well, even a small one," said Lucy, "I should like to see; for I never saw a balloon in my life."

Sir Rupert went back to Edward's press, and took down from the hook on which it hung a bag or bladder, about the size of a man's head.

Harry observed it was thinner than any bladder he had ever seen. It was a ready-formed globe, in which he could discover no joining. He asked what it was made of. From what he had heard

about the caoutchouc ball he began to suspect that this little balloon might be of the same substance.

“Animal or vegetable, sir?” asked he.

“Animal,” answered Sir Rupert. He told them it was the craw of a turkey.

Harry began to blow into it to swell it out, that they might see its full extent. Sir Rupert desired him to take care what he was about, and to handle it gently, for it was one of his son’s most precious *valuables*. It was the craw of an uncommonly large Norfolk turkey, and had been peculiarly well prepared. Some skill and care were necessary, he observed, in the cleansing and preparation. He knew that his housekeeper had spoiled several before the art had been attained so completely as to render them thus inoffensive to smell, and so light as to be the balloon-maker’s joy.

Lucy admired its delicate texture, and *no* weight. Harry observed that there had been several little tiny holes in it, not larger than pin-holes, which had been carefully patched.

Yes, as Sir Rupert said, it had been in truth most carefully patched: he had seen his son at it for half a day. Sir Rupert bid them guess how Edward had contrived to detect all these small fractures, which were scarcely discernible before the patches had marked their situation.

Lucy thought, that, in the first place, he must have blown air into the craw, so as to swell it out

nearly to its utmost extent, and then he might have pressed it to discover where the air came out, and there he must have applied his patches.

"This was the way he first tried," said Sir Rupert, "but his feeling was not acute enough. He was obliged to think of another method. Can you invent what that was?"

Lucy, at this moment, saw a bit of downy feather, which was floating in the air. Sir Rupert observed her eye caught by it, he said, "That is a good idea, Lucy. Edward held a bit of down, as light as this, to the parts of the balloon where he suspected there were holes; and as he pressed the balloon the motion of the light filaments gave him notice of the place from whence the air issued; but this down was not sufficiently sensitive to detect the smallest holes."

"Perhaps," said Harry, "Edward went round it with a lighted taper, holding the flame as near to the surface as he could, without endangering its safety, and at whatever place he perceived that the flame of the candle was blown he must have been sure that there was a hole."

"You are right, Harry," said Sir Rupert. "This way succeeded very well, and still better when he fixed the light, and turned the globe round, so that he might try each part in succession."

"But why was it necessary to fill up every little hole so excessively carefully?" asked Harry.

“My uncle’s balloon went up very well without all that care.”

Sir Rupert asked of what size it was and with what it was filled.

“It was about ten feet in diameter,” answered Harry. “It was filled with hot air from a fire of lighted straw, over which its mouth was held.”

Sir Rupert explained to him, that the turkey’s craw was to be filled with hydrogen gas, which is much more difficult to confine than the common heated air that had been used for filling the balloon Harry had seen at his uncle’s.

Lucy was very much afraid that Harry would ask some further question before she should have time to make a petition which was on her lips, and which was keeping her breathless with anxiety.

“Well, my dear Lucy,” said Sir Rupert, taking compassion upon her, “say whatever you want to say.”

“I wish I could see a balloon go up,” cried Lucy; and the vehemence of the exclamation expressed the strength of the wish.

“Then you shall if we can manage to send one up for you,” said kind Sir Rupert. “But only this small one; I have no other: will this content you?”

“Oh, yes! thank you, sir,” said Lucy. “Any one, for I never saw any.”

Sir Rupert asked how it had happened that

she had not seen that which Harry saw at his uncle's?

"Because she was not there. It was at the time of her long visit to Aunt Pierrepont," Harry said; "and I hope she will never be away so long again."

Then turning to the balloon, Harry's and Lucy's attention anxiously waited for what Sir Rupert should say next. To their great satisfaction he determined on filling the little balloon that very day; he would immediately look for the materials for making the hydrogen gas, and explain the process, which was very simple. He said that he knew he might leave them to Harry's care; though it was not to every one of his age that *sulphuric acid* should be trusted.

Harry and Lucy, in the same breath, though in different tones, said, "Thank you! Oh! thank you, sir."

"But before we go to the sulphuric acid, sir," said Harry, "could you be so kind as to tell us something more about balloons? I mean of their use. I have seen only one, and know very little about them."

"From what you said just now," said Lucy, "I understand that there are different kinds; I should like to know how they differ. But what I particularly wish to hear is how balloons were in-

vented ; if you would be so very good as to begin at the very beginning of their history.”

“Then I must go back again to the reign of Charles the Second,” said Sir Rupert, “and even to an earlier period, about four hundred years before his time, when, as the biographical dictionary-makers would tell you, *flourished* one Roger Bacon—not the great philosopher Bacon—but a monk, a most ingenious man, with whose name, perhaps, Harry is acquainted. He who made that brazen head which is said to have pronounced the words, ‘Time is, Time was, Time will be.’ Whether his brazen head ever pronounced these words, or any other, I will not take upon me to decide. You may judge of the probability for yourselves,” added he, smiling : “but, what is more certain, he made a discovery which was scarcely less extraordinary—gunpowder ; and it was he who invented, Lucy, what is more in your way, and will please you better, the camera obscura. It was this Roger Bacon that first suggested the possibility of a machine, by which a man might mount into the air. But none believed him. Some hundred years, as usual, passed between the first suggestion and accomplishment of a great invention. Nothing more was done or attempted after *Roger the Great’s* time, till the days of that constellation of scientific men, who shone forth at the first

establishment of our Royal Society, in Charles the Second's reign.

“At that period there arose another bold genius, of the name of Wilkins, a daring inventor, who rather imprudently published, before he had actually tried the experiment, that he should soon be able to fly with wings of his own contrivance. By the aid of these wings he was not only to raise, but sustain himself in the air, and to travel in a flying chariot, which, by mechanical means, he promised himself he could guide at pleasure, and raise or lower by the movement of his wings. He further prophesied, that in future times ‘men would travel through the air as commodiously and as easily as on the water or on the earth ; and that the day would come when people would call for their wings, in setting out on a journey, as commonly as men call for their boots.’ Those were his words, and they have been too often repeated in scorn of projectors and inventors.”

“I am sorry,” said Harry, “that he was so imprudent as to boast beforehand, whatever he might hope. Did he try any experiment?”

“He tried, and tried, but—

‘Let him try of wood or wire,
He never got two inches higher.’”

“I am sorry for it,” repeated Harry. “I cannot bear when ingenious men do not succeed in

their inventions, for then stupid people laugh at them."

"Therefore ingenious men should be prudent, Harry, and not *bolt* out their inventions before they have tried them. The wings did not answer, and, as there appeared to be little probability that his audacious prophecy would ever be fulfilled, the world, both learned and unlearned, joined in laughing at Wilkins, and at his wings, and his voyage to the moon. Even philosophers deemed it beyond the powers of mechanism or science for man to mount and sustain his flight in the air; and common people expressed their sense of the impracticability or visionary nature of any scheme, by saying, 'It is as impossible as to fly, or to mount above the clouds.'"

"Yet this was not impossible for science at last!" exclaimed Harry, triumphantly.

"About the same time," continued Sir Rupert, "an ingenious Jesuit, of the name of Lana, laying aside the idea of wings, thought of mounting in the air on thin hollow copper globes, in which he had produced a vacuum."

"A vacuum! very ingenious," cried Harry. "Did he succeed?"

"No, poor man, he failed with all his ingenuity; he did not know how to make his vacuum perfect enough: besides, the weight of his copper balls was too great; and, when he made them very thin,

the pressure of the atmosphere drove them inwards, and destroyed them."

"Ah! there was no resistance within," said Harry. "Who came next?"

"Another ingenious man, Galien, who wrote a little book, in which he plainly said, that if any lighter kind of air than the common atmosphere could be found, and if a bag were filled with it, people might mount by means of it into the air."

"That is exactly the description of a balloon, is not it, sir?" said Harry.

"Yes; but he never discovered this lighter kind of air," said Sir Rupert.

"He only said *if*," said Lucy.

"His principle, however, was quite right, but there it remained; no one applied or pursued it for another century, till at last the simplest observation imaginable led again to the right point. From observing the smoke rising in the air, and clouds floating in the atmosphere, it occurred to Montgolfier—"

"Montgolfier!" exclaimed Lucy; "now I know we are coming to real balloons."

"It occurred to Montgolfier," continued Sir Rupert, "that, if he could confine the smoke or the cloud in a bag, it would rise into the air, and that, if he could fill the bag with it on earth, he could mount along with it to the skies. Pursuing these ideas, he observed, that air, when heated,

is lighter than when not heated, because it is more expanded, more rarefied, and he resolved to try heated air for his balloon."

"Now he has it!" cried Harry.

"Yes," said Sir Rupert; "when filled with heated air up it went. Then his next ambition was to make a balloon that should not only rise itself, but carry him up also. For this purpose it was necessary to ascertain what size would give it sufficient power. When the capacity of a balloon is such, that the difference between the weight of the light heated air that it *contains*, and that of the heavier atmospheric air which it *displaces*, is exactly equal to the united weights of the man, the car, and the balloon, then that balloon will just float in the air. But, as we find that the atmosphere is gradually thinner and lighter in proportion as we rise above the earth, so it becomes necessary to make the balloon considerably larger, in order to ascend to any great elevation. You see, Harry," continued Sir Rupert, "how necessary it was for this great inventor to know how to calculate with exactness, or he would never have mounted in triumph into the air as he did."

"He did mount, then?" cried Lucy. "Oh, yes! I know he did."

"This balloon was filled with air, rarefied or heated by a fire of straw made underneath it," continued Sir Rupert; "and crowds of spectators

assembled at Paris to see the first public experiment, which completely succeeded. But I need not describe it, as accounts of it can be read in so many books, in prose and in verse."

"But how did he keep up?" asked Harry. "for, when the outside air cooled the heated air inside his balloon, he must have come down."

"Very true, Harry. But then he carried fire up with him, fastened to the bottom of the balloon, to keep the air within constantly rarefied."

"Was not that very dangerous?" said Lucy.

"It was," said Sir Rupert. "Those fire-balloons are very dangerous."

"And, besides," said Harry, "how could they carry up weight of fuel enough to supply the fire?"

"Yes, that was another difficulty," said Sir Rupert.

"And how were all these difficulties conquered?" said Harry.

"They are not all conquered yet," answered Sir Rupert. "But some improvements have been made."

"By what means, sir?" said Harry.

"Principally by chemical means. Long before the time of Montgolfier, philosophers had discovered a kind of air, or *gas*, that was much lighter than atmospheric air. It was first called inflammable air, from its property of easily inflaming, but now it is called *hydrogen gas*."

"Then still even that was dangerous," said Lucy.

"Yes," said Sir Rupert, "but it only inflames when it comes in contact with flame; if we keep it from this it is safe."

"Well, that was much better," said Lucy, "than carrying up fire flaming under the balloons. Then they filled them with this hydrogen?"

"Not for some time. First one man said it might be tried, and another man tried it—but only in blowing large soap bubbles. At last three ingenious chemists employed this gas in filling a large balloon, which was made of silk, and well varnished to keep it from escaping."

"And I hope that kept it in tight," said Lucy, "for then the man might stay up in the air as long as he pleased."

"It kept it in too well," said Sir Rupert; "as it rose very high, the outward pressure of the atmosphere became so much less, that the gas expanded with great force, and, having no way to escape, the silk burst, and down fell the balloon."

"And the poor men!" said Lucy, "what became of them?"

"They did not go up in it," said Sir Rupert; "but the experiment succeeded so well, that the inventors resolved to try it again; and this time to go up themselves; for now, having considered what caused the accident, they thought that they had

found out a way of preventing it from happening again."

Sir Rupert paused to give Harry time to think what way.

Harry said to himself, the balloon burst because the gas could not get out when it expanded. "Perhaps, sir," said he, "they put a valve to their balloon, something like the 'safety-valve of a steam-engine, so that they could let some of it out when they liked."

"Just so," said Sir Rupert.

"This succeeded, then," said Lucy. "How far did they go?"

"About a league, as well as I remember," said Sir Rupert.

"Only a league! three miles," said Lucy. "I thought people had gone much farther in balloons."

"Much farther some time afterwards," said Sir Rupert. "One man crossed the sea from England to France, and another went three hundred miles in a few hours—seven, I think."

"Three hundred miles in seven hours! That is real flying!" said Lucy.

"I wish I had been with him," said Harry.

"He was in great danger," said Sir Rupert. "He went up at night; his balloon was filled with this inflammable gas, and illuminated by several lamps hung round it."

"How beautiful it must have been!" cried Lucy.

"But very dangerous," said Harry; "for how could he let out the gas, when it was necessary?—the lamps would have set it on fire."

"He was not quite so imprudent as you think," said Sir Rupert; "he had provided a contrivance for keeping the hydrogen safe from the lamps, as well as to permit his letting it out occasionally during his voyage; but it happened that, at the time his balloon was filling, the mob of Paris crowded round it, and they were so impatient that they would have torn it to pieces if he had delayed; they would not even give him time to adjust his apparatus to the safety-valve. He rose with unexampled rapidity high above the clouds; the balloon suddenly expanded; he saw the danger, but from fear of the lamps he dared not let out the hydrogen. It swelled more; he saw it must burst in another minute. What did he do, Harry?"

"He put out the lamps," answered Harry.

"Yes," said Sir Rupert; "with one hand he stretched to the lamps, and extinguished as many as he could reach, while with the other he tore a rent in the balloon, to let out the gas. The inflammable air was discharged in great quantities, and thus his presence of mind saved him."

"Great presence of mind indeed!" said Lucy.

"I wonder how people can think at all, up in clouds at that terrible height, and no possible assistance near them."

She wished to hear more entertaining adventures of people who had gone upon voyages of discovery in balloons.

Sir Rupert told her that he would put into her hands a book, in which she might read all the adventures of these aeronauts, or aerial voyagers; related, as he said, in a much more amusing manner than he could tell them. "I will look for the book for you in the library, and you may read it before you see our balloon go up, or afterwards, whichever you please."

"Before, if you please, sir: I should like it now," answered Lucy. "It is so pleasant to read about things at the very time when we are thinking of them. Harry, will you come and read it with me?"

"No, thank you," said Harry; "if one of us read it, that will do; you will tell it to me afterwards, and I want to see how this balloon is to be filled."

"I should like to see that too," said Lucy.

Sir Rupert began the operation. He put some filings of iron into a bottle, and upon these he poured sulphuric acid, diluted with about six times the quantity of water.

Lucy, as soon as she saw the sulphuric acid,

kept at a safe distance. She did wisely. When the acid was poured upon the iron filings, a cloud of white vapour rose, and she perceived a peculiar smell. Sir Rupert told her that the gas, which was then rising, was hydrogen, and with this the little balloon was to be filled:

Sir Rupert then took a bent glass tube, which was open at both ends ; one end he placed in the neck of the bottle, and the other in a jug almost full of water, so that the gas, after passing through this tube, was made to rise through the water in the jug, in order to purify it : over the jug he put a glass funnel, with its broad mouth downwards, to collect the little bubbles of gas which rose to the surface of the water. Sir Rupert having placed this apparatus on the floor, took the little balloon, and suspended it from a walking-stick, which he laid on the backs of a couple of chairs ; the aperture in the bottom was tied fast round a piece of quill, about an inch of which was left projecting beyond the place where it was tied ; this he put into the small end of the funnel, and plastered round their joining with a *lute*, made of that which was ready at hand, some almond paste and water, and he also luted the glass tube into the neck of the bottle. The joinings being now air-tight, none of the gas could escape, except through the quill, which left an open passage for it into the balloon.

Presently Lucy saw the bubbles rising more and more thickly through the water, and, as the gas ascended by the funnel, she observed that it began to inflate the balloon. As the affair, however, seemed to proceed but slowly, she thought it would be tiresome to stay till it was finished, especially as she could be of no use ; she said, therefore, that she was satisfied, and went to the library to read the adventures of the other aeronautic voyagers.

Sir Rupert accompanied her ; and, having kindly marked several entertaining passages, he returned to Harry, who, as he said, would want his assistance.

FIRE-BALLOON.

LUCY had time to read all that Sir Rupert had marked in the history of aerial voyages before the little balloon was filled. She found Harry alone in the laboratory when she returned, holding the balloon, which was now a perfect globe, quite inflated. He showed her, that the quill was stopped at the bottom by a little plug of cork, which Sir Rupert had stuck in when the balloon was sufficiently expanded, so that he might clean off the luting without fear of losing any of the gas.

"I am glad Sir Rupert staid to do all this for me," said Harry, "and that I have seen how quick and dextrous it is necessary to be with it. You are come just at the right time, Lucy," added he, "we had but just finished."

"Let go the string, Harry, by which you are holding the balloon," said Lucy, "that I may see if it will go up."

"Go up! to be sure it will," said Harry. "Look how it pulls against my hand. I am fas-

tening this little weight to the bottom of it : I think it will carry this up also."

"That little weight!" said Lucy; "is that all it is able to carry?"

"All! and a great deal it is," said Harry, "for such a small balloon."

"It may be a good weight for it to carry in proportion to its size, to be sure," said Lucy. "Now, Harry, pray loosen the string. There—there—up it mounts."

"But I do not wish it to mount too high, or to strike itself against the ceiling," cried Harry. "I must add more weight."

He added a little more weight, and tried it again; and at length, to satisfy Lucy, he let go the string. It seemed to be nicely balanced above their heads, half-way between the floor and ceiling. After remaining still a few moments, it moved towards the fire-place; as if, as Lucy said, it wanted to warm itself; and, when it had remained there till it was warm enough, went away again. The fact was, as Harry observed, that the draught, or current of air, wafted it towards the fire-place; as it approached, the fire heated the gas within, so that the balloon rose higher towards the ceiling, and floated about till, the gas cooling, it descended, and, again wafted by the draught, the same movements were repeated. Harry observed them with untired interest, calling

out, "Now it rises, *because*—and now it falls, *because*, &c."

But after a minute or two Lucy said, "It is very curious ; but when will you let it up out of doors, Harry ? I want to see it go up to the clouds."

"As soon as my father and Sir Rupert come back," said Harry.

"In the mean time," said Lucy, "I will tell you what I have been reading. Sir Rupert might well say it was entertaining : but I cannot tell it to you if you are so entirely intent upon that balloon."

"But, my dear, I am not entirely intent upon it ; I can hear you very well."

"Ah ! you can hear, I know ; but you will not listen to me comfortably while you are watching that balloon."

"Then," said Harry, laughing, "you must watch the balloon, and I will listen to you while I am sharpening my knife ; and yours too, if you will give it to me. May I do that ?"

"Oh ! yes ; thank you," said Lucy, "I know you can listen while you do that. My dear Harry, do you know anything about *parachutes* ?"

"No," answered Harry, "nothing."

"I am glad of it," said Lucy, "for I can tell you something at least about *them* : parachutes

are used to prevent the danger in falling from balloons. The name parachute, from the French word *chute*, shows its use: it is a sort of umbrella, which spreads out of itself the moment it feels the resistance of the air, and that prevents it from coming too suddenly down. A man tried it first with his dog: he fastened him to a small parachute, and, when the balloon was at a great height, he dropped him out; the parachute spread, and—”

“Very well,” said Harry, “I see. The parachute must have been of use in preventing his descending too quickly.”

“So I thought, my dear Harry; and so it would have been, but for the wind. The wind blew, and blew till it was a great storm, quite a whirlwind; the poor dog and parachute were blown up and down, and all manner of ways, and at the same time the man in his balloon was equally tossed about, without power to stop, or to guide himself; at last, when the storm began to cease, man and dog came in sight of each other again, and the dog, knowing his master, began to bark, just as he would have done upon earth: once they came so close together, that the master stretched out his hand to take him into the balloon, but another provoking gust of wind whirled him away; however, at last, the man and the dog

came to the ground—man first, dog next, with his parachute quite safely.”

“ Then it succeeded, you see ! ” said Harry.

“ Yes, this time,” said Lucy ; “ but another time a poor man broke his leg, by coming down with a parachute ; and you must know, Harry,—I am sorry to tell it you—but I must, for it is the truth—a great many dreadful accidents have happened to people with these balloons ; one man was burnt to death, and several were near being drowned, by dropping into the sea ; they must have been drowned, but for some good-natured fishermen who saved them. Another balloon-man was in a terrible condition ; a thunder-storm came on, and he in the midst of it, up in the clouds : he says that at one time he was in a state of insensibility, lying at the bottom of the car—he does not know how long—then bounce came the balloon against the earth ; and, when it rebounded, he was dashed against a rock. Oh ! my dear Harry !—at last his anchor hooked in a tree, and this saved him. Philosophers may say what they please, but indeed I think it is very bad work, Harry ; I should not at all like to go up in a balloon.”

“ I am glad you would not,” said Harry, “ for I do not think it would be fit for you.”

“ But what is more, Harry, I should not

like that *you* should go up in a balloon," said Lucy.

"That is another affair," said Harry. "It is a man's business to brave danger.

"In a good cause," said Lucy.

"In a good and great cause, to be sure," repeated Harry.

"But then it comes to this—what is a great cause?" said Lucy.

"Is not the cause of science, my dear, a great cause?"

"I do not know," said Lucy. "I think it is quite enough if a man hazards his life for his country—for his father and mother, and friends, or for poor women, sisters, and so forth. You may ask my father as soon as he comes down stairs."

"Not now," said Harry, "we will talk of it another time; you know we are going to the balloon. But, Lucy, where is the balloon? Oh! Lucy, what is become of it? I told you to watch it."

"I do not know," cried Lucy, "what has become of it: it must be somewhere in the room, but I cannot see it. Look up on that high press—I will look under the tables."

High, and low, and everywhere they looked, but without seeing it.

"The windows are shut—the door is shut—

nobody has opened it—nobody has come in—nobody has gone out of the room since we had it safe,” said Harry.

“It must have burst,” said Lucy. “Look for the skin.”

“It could not have burst without some little noise, I think,” said Harry.

“We will settle about the noise after we have found the skin,” said Lucy: “but I cannot see anything like it. What can have become of it?”

Harry made another careful search in silence, and then said, “I am now sure that it is not in the room, and it could not have got out of the room any way but one.”

“What way?” asked Lucy.

“Up the chimney,” said Harry.

“Up the chimney!” said Lucy. “But now I recollect, it is very likely—you know how fond it was of going towards the fire.”

“It may have stuck in its way up,” said Harry, trying to look up the chimney, but nothing was to be seen.

“Nothing but darkness,” said Lucy, popping up her head as Harry withdrew his. Harry ran out directly, to try if the balloon could be seen hovering over the house. Where it had flown none could tell. One man had seen “something very odd” come out of the top of the chimney; another had seen this odd something pass over

his head—he had thought it was a kite—he could tell only what he had thought it was, and how much he was surprised when he saw that it was not what he had thought ; but more he could not tell.

Harry ran from field to field, jumped over ditches, and jumped back again ; and, breathless, hot, and tired, came home no wiser than he had gone out. Lucy all the time was exceedingly sorry for her carelessness, for which Harry never once reproached her.

They were particularly vexed by the loss of this little balloon, because it belonged to Edward Digby, who had, as Sir Rupert had told them, spent nearly a whole day in patching it. The more they thought of it, the more they grieved. Sir Rupert did all he could to comfort them, by saying, that he would take it upon himself to provide for Edward as good and great a Norfolk turkey's crow as that which was lost. " But," added their kind comforter, " I by no means give it up yet as lost, only strayed—certainly not stolen ; our neighbours and our neighbours' children are all honest and kind people. Some one will probably find our little balloon, and bring back its skin to-morrow. But now for to-day. I am sorry you are disappointed : I wish I had for you a beautiful little balloon I once possessed—my flying-fish."

"A flying-fish! I wish we had it," said Lucy. Harry asked what size it was.

"About four feet from head to tail, and broad in just proportion for a fish," said Sir Rupert, "with proper fins, and everything that could make it look like a real live fish. It was made of baudruche."

Harry asked, "What is *baudruche*?"

"Simply goldbeater's skin. Baudruche is the French name for it; and my thoughts going back to Paris, where I had first seen such a balloon, I used the name by which I had there heard it called. I gave my pretty fish to Edward, who was very young at that time. It was lost in coming over: it fell, I believe, into the sea."

"Very natural," said Lucy, "for the fish to go into the sea."

"But since we have not that, or any other," pursued Sir Rupert, "what can be done now? Since we have none ready made, what would you think of trying to make one for yourselves?"

"I think it would be the happiest thing in the world," said Lucy.

"If we could do it," said Harry.

"Why not?" said Lucy, "if we had anything to make it of."

Sir Rupert thought that Lady Digby, who it seems had everything that everybody wanted,

could perhaps furnish a quire or two of silver paper.

“Then we can soon make a balloon of silver paper, I am sure,” said Lucy.

“We have only three days more to stay at Digby Castle,” said Harry, sighing profoundly.

“Only three days, indeed !” said Lucy, echoing the sigh sincerely ; but in a more sprightly tone she added, “Three whole days ; and this remembrance is not half gone, Harry. But I wonder you are not more eager even than I am about our balloon.”

“My dear, I am eager about it,” said Harry, “very eager, but I see many difficulties ; and I am afraid we should only waste Lady Digby’s silver paper, which I know is valuable to ladies for their cap boxes.”

“I would not have you waste that, my dears, or anything else,” said Sir Rupert, smiling ; “but I can answer for it that Lady Digby, for such a purpose, will give her silver paper willingly, even out of her cap box, if it were necessary. However, not to raise the merit of her sacrifice, Harry, I can tell you that she happens to have a store of it, which she bought for Edward. There is much to be learned in doing anything of this sort well ; and so much ingenuity must be employed, that I am always a promoter of such things. I am always for letting my young friends try their own experiments.”

“But do you really think, sir,” said Harry, “that we can succeed?”

“Tell me how you would set about it, and then I will give you my best opinion,” said Sir Rupert.

“I do not know,” said Harry: “I only know that it is exceedingly difficult; for I recollect that, when my uncle’s balloon was making, he and my father were calculating and measuring with long tables of figures and scales, and beam-compasses—but I could not understand what they were doing.”

“But that was a year ago, Harry, you know,” said Lucy.

Sir Rupert took them to the library, and showed them, in one of the plates of the Edinburgh Encyclopædia, the *gore* of a balloon, with all the requisite dimensions marked on it.

Lucy was awe-struck at the sight of a diagram with curves, and crossing-lines, and, as she said, “with decimals innumerable.” But Harry’s hopes began to revive. “You once,” said he, “covered a ball for me, Lucy, and its cover was divided into gores, which were very like this; they were all of different colours, I recollect, and very pretty.”

“There was no great difficulty in that,” said Lucy; “the ball was very small, you know, and ready shaped for me. I measured it round, and divided it into an equal number of parts, and

counted how many gores of such a breadth, in their broadest part, would go round it; and then I cut a pattern in paper, sloping it, and guessing by my eye, and trying repeatedly what would fit: then I cut all the leather gores by my paper pattern, stuck them round the ball with pins, and by measuring and cutting, pulling and pushing, and puckering, stretching, and coaxing, the ball was at last finished."

Lucy showed the manner in which she had creased her paper in various directions, in order to make her pattern, but Harry thought it exceedingly difficult and incomprehensible. Sir Rupert, to whom the case was referred, thought that Lucy's method might do, if she took care to allow sufficient margin for joinings; and to admit of letting out, or drawing the pieces closer together, as occasion might require, to compensate for inaccuracies.

The chief difficulty now seemed to be the shape of the pattern gore; but Lucy's alarm at the "innumerable decimals" not having yet subsided, and Harry still fearing that a large part of the "three days" would be consumed in making himself sufficiently master of the subject to construct it with mathematical accuracy, Sir Rupert compounded with them for a method, which, he said, would answer well enough for a first attempt.

"Let us determine," said he, "what is to be

the shape and size of your balloon. Suppose it to be a globe of eighteen feet in circumference—in that case, twelve gores will probably be enough; and the greatest breadth of each of these must evidently be eighteen inches, or a little more, to allow for a pasting margin. It is equally clear that their length must be half the circumference of the globe, or nine feet. To make your pattern, I would advise you to paste some sheets of brown paper together, so as to form a narrow parallelogram of nine feet long and eighteen inches wide. This, you know, must be tapered to a point at each end: not by straight lines, but, as you observed, Harry, by curving the sides; and, as you are doubtful of accomplishing this with geometrical precision, I think we may trust to your eye to draw the curves.”

Harry and Lucy were eager to begin on the strength of these directions. “But now,” thought Harry, “what sort of a balloon shall it be?” He asked Sir Rupert if he had ever seen a balloon which carried up fire with it to keep the air within rarefied?

Sir Rupert said that he had seen several: one in particular he well recollected; “its paper cover,” said he, “caught fire when at a considerable height in the air; it seemed a globe of flame, and, for a second or two that it retained its form, made a most beautiful spectacle. But, Harry,”

said Sir Rupert, suddenly checking himself, "are you thinking of sending up fire with your balloon?"

"Oh yes—why not, sir?" cried Lucy; "I should like very much to see it take fire in the air."

But Sir Rupert said he could not consent to this—he thought it too dangerous. "There are several thatched houses, and ricks of corn and hay in this neighbourhood," said he, "and, if the balloon fell upon them, it would set them on fire."

The moment that this danger was pointed out, Harry abandoned all further idea of a fire-balloon, and asked whether he might fill it with hot air.

Sir Rupert willingly consented to this, and told him that they should have a chafing-dish, with burning charcoal, by which the balloon might be filled, with less danger of setting it on fire than if they lighted a fire of straw under it. Sir Rupert added, that, though the sending up fire with a balloon from his park would be hazardous, yet there were other situations in which it might be done without danger: for instance, when they returned to the sea-shore, they might, if their father approved, try one when the wind blew towards the sea. Sir Rupert sat down immediately, and wrote for them the following directions, which were committed to Lucy's memorandum book for a future occasion.

Choose a calm dry evening; and, having erected in the ground two poles, at a sufficient distance apart to prevent the balloon,

when inflated, from touching them, pass a string through the ring at the crown of the balloon, and fasten the ends of it to the tops of the poles; then, in order to inflate it, place a chafing-dish, with burning charcoal, under the opening at the bottom; it will presently swell out, and consequently rise to a greater distance from the chafing-dish, which will enable you to hook on a small wire-basket, containing a sponge soaked in spirits of wine; this basket will also help to balance the balloon when in the air. The string on which the balloon is suspended must be cut at the moment that the spirits of wine in the sponge are lighted.

There is no ancient saying of which the wisdom is more cordially felt by youth, than that "they who give quickly give twice." Lady Digby immediately ordered for them a large deal table, placed in one of the spacious unoccupied bed-chambers, where, the carpet being rolled up, they might use floor or table, as they liked: she also provided them with a dish of good paste, two paste brushes, two towels, the housekeeper's large cutting-out scissors, a pair of compasses, a long ruler, and in short all they could want, including what only her kindness could have suggested, two pair of steady able-bodied clothes-horses from the laundry, on which to hang their long sheets of pasted paper to dry. They set to work. Lucy's first business was to paste the sheets of silver paper into the narrow parallelograms, while Harry was intent on his brown-paper pattern.

Harry's pattern ready, Lucy cut out all the twelve gores in the silver paper, leaving "ample room and verge enough" in the margin to com-

pensate, if necessary for inaccuracies. Then came the *magnum opus* of putting together the gores. They proceeded not without many little disasters, too tedious to relate. Lucy handled her brush in a masterly style, lightly and evenly; ever keeping strictly within her bounds, she swept along with steady and determined hand to the end of her course; at last, each pair of gores was pasted together, and each having been allowed time to dry—the patience necessary for which being the greatest trial of all—the whole was, with a little coaxing and a little puckering, joined together. It was necessary that the balloon should open wide, so that it might be held over the fire to be filled with hot air, therefore the lower points of the gores were cut off, and the bottom was pasted round a light hoop of cane. When they thought the balloon was finished, Lucy put her delighted head within it, to contemplate the inside; but to her great dismay she saw various little holes in the paper, and the remainder of the day was spent in putting patches over each detected flaw.

On the morning of their last day, the weary business of patching was ended. Each hole had its patch, and every patch was dry, and never did artists contemplate their work with more satisfaction: Lucy, with a few exclamations of delight; Harry, with sober, silent admiration. They stood before their balloon, and wondered that it had

ever come together; and father and mother, and Lady Digby and Sir Rupert, successively joined in the same surprise and admiration, with sincere congratulations. In the moment of success, the general gave due credit to his lieutenant, Lucy, without whose assistance, as he was proud to acknowledge, all his generalship would have been of no avail. He handsomely acknowledged the skill with which all had been performed that was left to her discretion; though, perhaps, he still more admired that which those in command often prefer to ability—prompt and mute obedience.

It was a fine evening—the sun just setting—out they bore their balloon to an open space in the park; it was suspended from the top of the poles which had been prepared, and the burning charcoal was placed under the opening at the bottom, to inflate it. In a few minutes the flaccid bag began to swell out, fold after fold. The last gleam of sunset, however, disappeared, before it had completely expanded. It now pulled slightly against the hands of the holders-down; they had orders not to let it go till the word of command should be given. Lucy, who was one of the holders-down, felt that it was hot service, but Harry was beside her, and, emulous of his fortitude, she stood firmly till she heard “let go.” Up rose the balloon—majestically high, yet full in view; and paused awhile, hanging in mid-air,

like a silver moon from the blue sky. The balloon again wafted upwards, and again stood still. There was now seen a beautiful light on one of its sides; Lucy thought it could not come from the sun, because it had disappeared beneath the horizon. It had set for them; but, as her father told her, those who had gone up in balloons had sometimes seen the sun set twice; once while on earth, and once when raised above it. This appearance lasted but for a moment or two: a fresh breeze arose—the balloon sailed rapidly along; they eagerly followed it with their eyes, but it did not sail far; it wavered, and turned sideways, and fell—fell—fell on a thorn-bush, never more to rise.

“It is all over,” said Lucy. “But was it not beautiful, Harry? Have we not had a great deal of pleasure, Harry?”

Harry walked on in silence, bearing the mangled remains of the balloon.

“After all,” continued Lucy, “when a balloon does not carry anything up with it, I do not see that it is much better than a kite.”

This insulting remark roused Harry from his silence. But, when he had said all he could about the ingenuity and curiosity of the invention, Lucy still pressed him to tell what use had been made of it; and Harry, embarrassed, looked to his father

and Sir Rupert for assistance, and whatever they could they supplied.

Once a balloon had been used for *reconnoitring*, that is, for discovering the situation, forces, and movements of an hostile army. Balloons have also been employed in trying some magnetical and electrical experiments. One ingenious man employed a balloon on purpose to try a philosophical experiment on sound; he sent up explosive materials for this purpose, to be let off at different heights, but the shouts of the crowd below prevented these from being heard.

“And nothing more found out yet! No more use made of balloons!” said Lucy. “Oh! Harry, what have you to say now?”

“That they have gone fast out of favour with you ever since you read and thought about the danger,” said Harry. “However, I must acknowledge it is surprising that such a great invention has not yet been of more use.”

Sir Rupert observed, that one reason for this had been, that it was so expensive to make balloons that poor philosophers could not afford it: the expense, however, has now been somewhat diminished by the use of coal-gas in the place of hydrogen. Balloons, he said, were generally sent up merely as shows, and paid for by people who went to see them merely for amusement; the ex-

hibitors, therefore, thought only of producing a grand effect; for instance, they made one to represent Meg Merrilies, another was a figure clothed in a flame-coloured robe, and another was a Pegasus transporting a richly-accoutred warrior through the clouds.

"Oh," said Lucy, "I wish they could manage the balloon Pegasus as the man in the Arabian Tales managed his flying-horse; by turning one peg he went up, and by turning another he came down."

"That may be done yet, perhaps," said Harry, "by turning one peg to let the air out, and another to let it in. If we could but guide balloons, then, indeed, they would be useful."

"And not till then," said his father.

"But do you think, father, do you think, Sir Rupert," said Lucy, "that the way of guiding them will ever be found out?"

Harry looked eagerly from one to the other, in hopes of a favourable answer.

They would not say it was impossible; they could not say they thought it probable.

"There was a time when it was thought impossible to do what is now done," said Harry; "who knows but the means of guiding balloons are close to us, and under our eyes and hands, just as the rarefied air for raising them was ready long before men invented how to use it?"

“True and sensible,” said Sir Rupert.

Encouraged by this acknowledgment, Harry inquired what attempts had ever been made to guide balloons. He exclaimed, “What a glorious thing it would be! What signifies the danger?—men must die some way or other.”

“Well done! well done, Harry,” said Sir Rupert, smiling; “I believe you have hopes of being a balloon-guider yourself.”

Harry blushed, and was silent. After a pause, he said, in a low voice, to his father, “I may, at least, think on the subject, father.”

“There is no reason why you should not think of it, if you like it, Harry,” said his father; “but many great men have thought of it, and failed: there is, however, nothing to be ashamed of in this wish, it springs from a praiseworthy ambition.”

“And let his ambition take its flight,” added Sir Rupert. “Recollect our own schemes when we were boys; our grand magnet scheme, and our efforts to invent perpetual motion. The worst that can be said is, that, though it does us no harm, it does nobody else any good.”

DEPARTURE.



IT may be a satisfaction to some kind young heart, or to some equally kind old heart, to be assured, that Sir Rupert was not mistaken in his good opinion of his neighbours and his neighbours' children. The little balloon was brought back by one of Farmer Dobson's young folks ; but, though Farmer Dobson himself accompanied his boy to bring back this *stray*, or *waif*, as he called it, to the lord of the manor, yet it was now little likely to be of any further use, and no longer worthy to be placed among Edward's valuables ; for it had first stuck upon the branch of a tree that overhung Higglesham Ford, then it had fallen into the ford, and just at the worst place it could have fallen—where the cattle came to drink : some beast had set his foot upon it, and the great half-moon rents even Lucy could not hope to repair.

It was all over with it as a balloon, but still its remains were treated with respect, and deposited in a drawer with remnants of other turkey-craws. They might be of service still to balloons yet unborn, which could be mended only by patches of the same stuff.

“ But I do not know whether my son will care about balloons so much,” said Sir Rupert, “ now that his object has been accomplished by other means.”

“ What was his object ?” asked Harry, eagerly.

Sir Rupert told him that the sea-coast in that neighbourhood was dangerous—vessels had been driven on shore, and had been wrecked—property and lives had been lost—and Edward’s imagination had been struck with the thoughts of contriving means of affording assistance to these poor shipwrecked people. He knew that it was often of the utmost consequence to be able to carry out a rope from a vessel in distress to the shore ; and he had at one time had an idea that small balloons might, when the wind served, be used for this purpose ; but the object had been lately accomplished in an ingenious manner, by simpler means. A method had been invented of sending a rope from a vessel to the shore by means of a kite, which could be made to descend at any place or time required. “ By-the-by, Harry,” said Sir Rupert, “ you cannot do better than read the account of this invention ; I am sorry we did not think of it sooner, that we might have tried it ; but you shall have the book, and take it home with you. I dare say you will be able to make a kite of this sort for yourself. It

is a new and perfectly safe invention for you to try—no gas necessary—no fire—nothing dangerous—and something really within your power and present means to accomplish for a useful purpose.”

Harry's mind seized the idea instantly with enthusiasm.

“ Yes,” added Sir Rupert, “ even the electric kite, which drew down lightning from the clouds, and which led to the use of conductors, to save us from the danger of thunder storms, could not be more useful than such a kite as this, which might save the lives of thousands.”

Sir Rupert went with Harry immediately to the library to look for this book, and some others which he and Lucy wished to borrow. They were welcome to any, upon condition that they wrote down their names in what was called the *Book-book*, a small volume which lay with the catalogue upon the library table, and in which a debtor and creditor account was regularly kept of all that were borrowed and returned.

Besides the 41st volume of the “ Transactions of the Society for the Encouragement of Arts,” in which there was the description of the kite, Harry wrote down “ Priestly's History of Vision,” 2 vols., in which he particularly wanted to read about the camera obscura. Lucy wished to have that book of Franklin's, which she had been looking at the

day they were at the electrical machine, for the sake of some letters which she had seen at the end of the volume. Harry found the volume again readily for Lucy. What she alluded to were entitled "Letters to a Young Lady on Philosophical Subjects," in one of which the author says to her, "Your observation on what you have lately read concerning insects is very just and solid. Superficial minds are apt to despise those who make that part of the world their study as mere triflers; but certainly the world has been very much obliged to them."

Lucy wished also for a little volume which she had seen in Lady Digby's book-case, called "Nourjahad," the beginning of which had excited her curiosity. Lady Digby consented, though it was a very favourite book, as it had been given to her by her father when she was about Lucy's age. She also lent her two very interesting accounts of shipwrecks, "The Loss of the Winterton," and "The Voyage of the Alceste."

Sir Rupert's last kindness to Harry and Lucy was the lending and explaining to them the use of a *pentagraph*, an instrument for reducing maps or drawings. Dr. Wollaston's *camera lucida* he promised to show Harry the next time he came to see him.

Harry was very happy to hear those words, *the next time*.

Sir Rupert expressed his desire to see him and Lucy again whenever their father and mother would bring them ; and it was settled that they should spend another fortnight at Digby Castle, making it their way home.

As Lucy was listening most attentively to this interesting arrangement, she was startled by the sound of a carriage : she looked out of the window, and saw that it was their own, driving to the door.

“ Is it possible ? ” cried she. “ I thought it was much earlier. Oh ! there is mamma with her bonnet on ! I did not think it was near bonnet time yet.”

But, alas ! it was come to that time and to that last moment when she must say *good-bye*.

How often they said good-bye it would be impossible to recount. We are sure of once in the drawing room—once on the steps of the house—once on the steps of the carriage—and again at the carriage window, and a good-bye as they passed the porter’s lodge, to the mother of As-tyanax.

But the present moment, as usual, pressed its claims to attention, and had its claims allowed. Harry began to settle the books in the carriage. Of their inconvenient arrangement, in the moment of farewell, none of the party had been fully sensible. But now it hurt Harry’s mechanical

feelings to see parcels sliding and slipping, unable to stay in the places assigned them, as these were in direct opposition to the laws of gravity. He set about to alter their arrangement, promising to make it infinitely more convenient to everybody. How inconvenient his elbows were to his mother, during this operation, need not be represented: it will readily be conceived by all who have ever been in a carriage with a *settler*.

Scarcely had Harry packed the books, and Lucy placed the great nosegay to her satisfaction in one of the pockets of the carriage, than they began a comparison of their feelings during their visit at Digby Castle.

“ I have been very, *very* happy ! ” said Lucy. “ Harry, let me tell you all the things which I liked, and then you may tell me what you liked best.”

What he or what Lucy liked best it was difficult to decide: Lucy seemed to think that “ all was best.” “ I hope,” she added, “ that Lady Digby’s nephews and nieces may be there at our next visit; how happily we shall play at hide and seek in the *annulled* apartments! I know a place where you would not find me for a year if I did not tell you—up through the trap-door, near the little staircase, leading to that observatory which you have not yet seen.”

“ I am to see the observatory, and Saturn and

his ring, next time," said Harry, "if next time ever comes."

"If! to be sure it will," said Lucy. "We have not seen half the park yet—we shall have delightful walks with Lady Digby—she likes long, rambling, scrambling walks. Harry, is not she a *nice* woman?"

"No," said Harry. "I like her because she is not *nice*."

"Not in the bad sense you mean; not *over* nice," said Lucy.

"Yes," said Harry; "I mean, that she is not one of those fine ladies who have always fine shoes, and who can never stir out of the house except on a fine day. She has strong shoes; and has the use of her feet, and her hands, and her head."

"And knows where everything can be found that is wanted," said Lucy, "and keeps everything in order."

"Yet does not plague everybody," said Harry, "by being too exact. Some people take every book off the tables the moment one leaves the room, and put everything out of the way, which they call putting things *by*."

"That would not suit Sir Rupert," said Lucy; "he said he did not like the look of any room where there were no books, and no signs of people being comfortably employed. I love the

look of the library and the drawing-room at Digby Castle: very different from Newcourt-hall, a fine house aunt Pierrepont took me to last year. My dear Harry, you can have no idea how tiresome it was! Lady Newcourt sat or lay on the sofa all day long, without having anything in the world to do!"

"I suppose the poor woman was a cripple," said Harry.

"No, she was not a cripple," said Lucy; "she could dance, though she could not walk. But I suppose that some days she was ill, though she eat and drank like other people every day: yet it was always said that Lady Newcourt was so very delicate! There was to be no wind in the room, and no noise—all the company talked in whispers; but indeed that was no loss, for nobody ever said anything worth hearing; nobody laughed, and nobody was allowed to yawn, excepting Lord Newcourt himself. He did yawn indeed; and aunt Pierrepont was so cruel as to send me to bed one evening for a fit of yawning, which I caught from him—so I never looked at him again in the evening; indeed I did not like looking at him at any time. At breakfast, he was so pale and miserable; at dinner, so red and cross; and at night, so stupid and sleepy. I believe he was unhappy because he had never anything to say."

“ But many people are happy enough when they have not anything to say,” interrupted Harry.

“ Are they ?” said Lucy, doubtingly.

“ Certainly,” said Harry. “ *Men* are often happy when they say nothing : for one, I am sure I am often happiest when—”

“ You ! yes,” interrupted Lucy, “ but there is a great deal of difference between saying nothing, and having nothing to say ; besides, Lord Newcourt not only had nothing to say, but nothing to do. Poor man ! with all his riches, and his fine Newcourt-house, and Newcourt-park, he was the most unhappy person I ever saw. Now I will make his face for you, Harry.”

Harry could not help laughing at Lucy’s imitation of Lord Newcourt’s dull face. She was going on mimicking his lordship’s yawn, and the manner in which Lady Newcourt lolled on the sofa, and her drawling affected voice ; but her mother stopped her by saying, that she advised her not to acquire the habit of mimicry.

“ Though it may be entertaining at the moment, Lucy, it is dangerous ; it would make people dislike you, and, what is worse, might lead you to say and do what is ill-natured, and for which you ought to be disliked.”

“ Oh ! mamma, I hope not,” said Lucy ; “ I did not mean to be ill-natured, but I cannot help

seeing the difference between people who are sensible or agreeable, and those who are stupid, or affected, or disagreeable. How can I help, mamma, seeing the difference between Lord and Lady Newcourt, with their ways of going on at Newcourt-house, and Sir Rupert and Lady Digby, and their manner of spending their time at Digby Castle? You would not wish, mamma, would you, that I should not perceive the difference, and that I should like them all equally?"

"Certainly I should not, my dear Lucy," answered her mother. "I am very glad that you can judge and distinguish what it is in the characters, and manners, and habits of those you see which makes them agreeable or disagreeable, happy or miserable; and I should be very sorry, by what I say now, to put any restraint upon your expressing before me, as well as to your brother, your natural feelings and opinions."

"Oh mamma, you need not fear that," said Lucy; "I should never feel afraid to speak before you; you tell me so gently and kindly when you think me wrong. Now, Harry, stop me, pray, the next time I begin to mimic anybody; and do not laugh, because that encourages me. I do not think I was quite right either, mamma, in another thing which, perhaps, you did not hear me say—about aunt Pierrepont's being so cruel as to send me to bed for yawning. I should

not have said that, because she was very kind to me, and I should be very sorry to be ungrateful—I should not have told the only little thing she did that was unjust.”

“Very true, my dear Lucy; and I am sure, since you have this generous feeling, that I need say no more on the subject.”

“Mother,” said Harry, “I am going to ask you a question; not on my own account, for I cannot complain of anybody having been unjust to me—but, when children have been punished unjustly, I want to know how they can help recollecting it?”

“They cannot help recollecting it,” said his mother, “but they can prevent themselves from talking or thinking of it, by which means they will avoid fixing the impression more strongly in the memory; and if, on the other hand, they try to recollect the kindness that has been shown to them, they will avoid the danger which Lucy so justly dreads, of becoming ungrateful.”

“Yes, mamma,” said Lucy, “I recollect hearing of that ungrateful girl, Miss Kitty Maples, who said—”

Her father interrupted her recollections, and gently desired her to look out at a place they were just passing. “Let us talk,” said he, “of things, not of persons.”

He stopped the carriage for a few minutes,

that they might look at the building which was near the road.

“What a strange ugly looking house!” exclaimed Lucy. “It is neither a house nor a castle!”

“This was the mode of building,” said her father, “which followed the time of Gothic castles in England. When fortified castles were no longer wanted for defence, people began to build houses with walls less thick, and without the moat, draw-bridge, and portcullis; they retained something of the old castle appearance, by way of grandeur, or because they had been used to it. But this style of building, which Lucy dislikes, appears now to be useless; and that is one reason, I think, why it looks ugly. Those blind towers, for instance, in which there are neither loop-holes to shoot through with bow and arrow, nor windows to light even a narrow staircase, are ridiculous.”

A short time after this, as they drove through a town, they took notice of some very old looking houses which seemed to be built of wood; they had projecting windows, which in the second story jutted out far into the street; and others like chequered frames, of black wood and white plastering: on one of these they saw the date 1560. Such houses were common, as their father told them, in the times of Elizabeth and James.

“ Did not we come through this town on our way to Digby Castle?” said Lucy. “ I wonder that I never took notice of these odd looking houses ; did you, Harry ?”

“ No,” said Harry ; “ we were thinking of something else, I suppose.”

“ But now,” said Lucy, “ that we have seen that Gothic castle, and chapel, and that we have learnt a little about such things, we take more notice of other buildings, and we feel interested about them, which is very pleasant.”

As they went on a little further, they met some loaded timber-carriages, and on one was a stone pillar, which, as one of the drivers told them, had been brought by water from far off ; they were going “ to a nobleman’s place near hand, who is building a fine house.” Harry’s father found that by turning a little out of their direct road they could see it, and he ordered the postilion to drive that way. When they arrived, they got out of the carriage to look at the building ; the scaffoldings were up, and many workmen busy at work : but enough was finished for Harry to see the style of architecture. It was Grecian, with a portico supported by Doric columns. Lucy said the front looked very like the print of a temple which they had seen the day before among the prints at Digby Castle. She could not recollect the name of it. Harry knew

it was the temple of Minerva, but it had another name, the *Parthenon*.* The architect heard what they said, and told them that this was built after the model of the Parthenon. He then spoke of some new buildings in London, and made use of several terms which they did not understand; but Harry had now seen and heard enough to make him anxious to learn more on these subjects. "How much there is to learn," said he, in getting into the carriage, "not only about building, but about everything!"

"Yes," said Lucy, "that puts me in mind of 'Alps on alps arise.' Harry, do you recollect that?"

"Alps on alps!" said Harry; "what can you mean, Lucy?"

She began to repeat some well-known lines of Pope. Harry recollected them; he had learned them from her some months before this time, and he begged that she would let him try if he could repeat them. "Only give me time," said he; "when I stop, do not tell me the next word directly."

"Very well; if you are out I will not put you in till I have counted a hundred, and that surely will be time enough for you to think, and for me to be silent."

Harry began boldly—

* From the Greek word *Parthenos*, The Virgin.

“ Fired at first sight with what—”

But with what, or by what he was fired, he could not recollect, before Lucy's hundred was fairly counted.

He observed, that these first lines, which he knew were something about the muse, he had always found very difficult but that, if Lucy would repeat four or five, he knew he could then go on cleverly. Lucy repeated—

“ Fired at first sight with what the muse imparts,
In fearless youth we tempt the height of arts,
While, from the bounded level of our mind,
Short views we take, nor see the lengths behind.”

“ Stop,” interrupted Harry, “ here is my difficulty ; I never could learn this by heart, because I do not understand it. ‘ Nor see the lengths *behind* :’ *behind* I think should be *before*. Does not the author mean, that, in climbing the height of the arts, we cannot see the length of way before us ?”

“ He does ; but the word *behind* is here used in another sense.”

“ What sense ?” said Harry.

“ Why, for instance,” answered Lucy, “ if you take away a little from what we have to learn, yet a great deal is left behind.”

“ Still there is a puzzle,” said Harry, “ as there always is when a word is used that has two senses ; we do not know in which to take it.”

“ Well, I cannot help it,” said Lucy, “ let me go on. You must not be so exact in poetry. You will see by what is coming that I am right.

“ But more advanc’d, behold, with strange surprise,
New distant scenes of endless science rise.”

“ Science !” interrupted Harry. “ Now, my dear, I can go on by myself.

“ So pleased at first the towering Alps we try,
Mount o’er the vales, and seem to tread the sky ;
Th’ eternal snows appear already past,
And the first clouds and mountains seem the last ;
But those attain’d, we tremble to survey
The growing labours of the lengthen’d way ;
Th’ increasing prospect tires our wand’ring eyes,
Hills peep o’er hills, and alps on alps arise.”

“ Quite perfect,” said Lucy.

“ And very well repeated,” said his mother.

“ Because I like these lines very much,” said Harry. “ In this poetry there is some sense as well as sound,” added he. “ It is true and it’s pretty, and it’s wise and it’s witty.”

“ My dear Harry, that is rhyme ! You will be a poet at last,” cried Lucy.

“ It will be a long time first,” said Harry. “ In the mean time here we are at home ; here is Dame Peyton’s cottage.”

“ And how well the roof looks, papa !” said Lucy ; “ and there is Dame Peyton coming out to welcome us.”

“ Mamma, do not you think that porch would be much prettier if it were covered with honeysuckle? I will plant some there to-morrow, or cuttings of *clematis*, mamma, or some quick-growing climber.”

H O M E.

It may be feared that, after all the dissipation—or, if dissipation be not the proper word, all the amusement and variety—they had enjoyed during this last fortnight at Digby Castle, Harry and Lucy might find it dull at Rupert Cottage. It will be feared by those who best know the nature of boys, that, after the great excitement of the workshop and the laboratory, with novelties mechanical, chemical, electrical, and aerial, opening to his view every day and hour, Harry would not be able to settle soberly to his necessary employments, and to plod on daily through the requisite portions of Greek, Latin, and mathematics. It will and must be feared by all who equally well know the nature of girls, that, after the polite praise and incessant attention paid to her by those two most uncommonly kind people, Sir Rupert and Lady Digby, Lucy would droop like a plant suddenly removed from the sunshine to the shade.

Harry and Lucy's father and mother had their fears on these points undoubtedly, and with some reason—as all fathers and mothers, as well as masters and governesses, will confess, those only excepted who have been blessed or cursed with the care of early prodigies of prudence.

It should be remarked, that a few words said by Sir Rupert Digby to both Harry and Lucy had operated on their minds to prepare them to watch over themselves, on their return home. He had shown that uncommon degree of justice, which considers not only what is agreeable to young people at the moment, but what is to happen afterwards to them, and to those who have the every-day care of providing for their happiness.

“ You know, Harry, that, if I were constantly living with you, I could not afford to give up to you so much of my time ; and I hope you will prove to your father and to yourself, when you go home, that I have done you no mischief. Lucy will, I think, follow your example whatever it may be, and this will be an additional motive for your assiduity.”

Harry had these words in his recollection the morning after he came home ; and when left entirely to himself, in his own room, he went to his mathematics first, and then finished his portion of Greek and Latin before he tried the new glasses in his camera obscura. When Lucy knew this, she could not for very shame go, as she had been desperately tempted to do, to “ Nourjahad ” instead of to arithmetic.

After breakfast, there was a new struggle in their minds : Harry was tempted by the sight of the books of shipwrecks, and was attracted by

the titles, in large characters, of the "Loss of the Alceste" and of the "Winterton;" and a page on which she opened in "Nourjahad," describing the good genius crowned with flowers, was almost irresistible to Lucy.

"It will be an evil genius to you, Lucy," said her mother; "for, if once it catches hold of you, it will keep you from everything else; of this I warn you, for I have myself felt the power of that genius. Our duties must be done first, and then pleasures can be enjoyed in comfort."

"I understand you, mamma," said Lucy. "There! I have put away 'Nourjahad.' But look at Harry, deep in the midst of the shipwrecks, though he advised me not to touch the books."

Harry threw down the "Winterton," and ran off to his business.

Lucy had undertaken to make a frock for Dame Peyton's grandchild; but, to say the truth, she had been a long time about it, and there was danger of its becoming as yellow as certain Indian muslin dresses, which the black servants, who are employed to embroider them for their mistresses, wind round their waists, and trail about the house for months, working at the flower or the leaf in the intervals of domestic employments. Lucy's frock was an example of beautiful running, and equally beautiful back-stitching, with one little border of satin stitch, smooth as any, save that which

Parisian fingers can perform. Her mother now reminded her that it ought to be completed, as the christening of the child was fixed for the next Sunday. There was one row of back-stitching yet to be done. Back-stitching, as everybody knows, is somewhat tiresome ; but what will not hearty good-will, aided by a little good sense and a little good example, accomplish ?

“ Harry has done all he promised,” thought Lucy, “ and so will I. Mamma shall see that I am not spoiled by all the amusement we had at Digby Castle ;” so thinking and acting accordingly, she completely finished her work, and held it up before her mother’s approving eyes.

It happened that Harry and Lucy were to spend that evening at home by themselves, their father and mother having gone to drink tea with the good old vicar, at a few miles’ distance. They had many pleasant things to do. Lucy, in the first place, went to try on her frock on the baby. The joy that appeared in Dame Peyton’s eyes overpaid Lucy for the labour of the work. The baby was asleep in the cradle, but the grandame, without ceremony, took it up to array it in its new vestments ; and, while Harry was out, digging the border ready for the cuttings of honeysuckle and clematis round the porch, the grandmother and Lucy had leisure to admire how pretty the child looked in its christening robe. The dame only wished that its mother were at home to see it ;

but the mother was gone to Digby Castle to visit her husband, who was a footman there.

Harry came into the cottage just to let Lucy know that he had dug the border for her, and must now run off to finish a job of his own—some steps which he was making to a bathing-place, near Dame Peyton's cottage. He told Lucy that he should finish his work in half an hour, and that then he would come to her.

"Pray, my dear Lucy," said he, "wait for me at the seat; do not come to see whether I have done my work, for I promise you I will go to you as soon as I can, and then we will read the "Shipwreck of the Winterton" together. Pray stay there patiently."

Lucy promised to wait for him patiently. There was, she thought, little danger of her not keeping this promise, when she had such a book as "Nour-jahad" to read. She read, and read on; at last, pausing at a good resting-place, just where Nour-jahad sinks into his second hundred years' sleep, Lucy looked round her, and saw the lengthened shadows of the evening. There was within view of her seat a projecting point of rock, whose shadow Harry had always consulted as his dial. Lucy now looked at its long dark form upon the water, and said to herself—

"It must be growing late, very late: I wonder Harry is not come."

She stood up, and looked along the path—no

Harry—nothing was to be seen. She considered what could have kept him so long.

“Perhaps some of the steps were wrong,” said she to herself, “and he has staid to alter them. I have a mind to go and see—but no, he begged that I would be patient, and particularly desired me to stay for him here.”

She took up her book again, and read on a little further, but with divided interest; every now and then looking up to see whether he was coming; at length, unable to fix her attention any longer, she put down the book. For the last two pages she did not know what she was reading. She had been inventing all manner of things that could have befallen Harry.

“I must go and see what has become of him,” thought she. “Why should not I? He bid me wait for him, that we might read the shipwreck here together; but, if I stay any longer, it will be so dark that we cannot read. Hark! he is coming.” No, it was only the rustling of the leaves.

“I cannot wait any longer—I may be of use to him—I *will* go. Oh! there he is! I see him among the trees! I am glad I staid.”

It was only a dog—but a boy followed, running full speed up the path towards her. Dame Peyton’s grandson! Lucy tried to go forward to meet him; but she was so much frightened that she could not stir.

DISASTER.

“WHAT is the matter? Where is my brother? Oh, speak,” cried Lucy, when the boy came near enough to be heard.

The boy, trying to look and speak composedly, answered, “Master Harry is at home, miss, by this time; I met him at the turn of the road with master and mistress, and Master Harry sent me off here to tell you, miss, not to wait no longer for he, but to come home, if you be pleased, miss.”

“Is that all?” said Lucy, relieved for a moment from her fright. “But that is not all, I am sure, by your look. Something bad has happened—tell me at once.”

“Why, miss, our house has been on fire, and half the roof burnt, they say. I can’t tell how it happened; I only met Master Harry, and the folks, as I was a going towards home, just at the turn of the road. Grandmother was the first I met, and she asked me where I had been; and I said with the cows; then she told me how our house had been all in a blaze, more than an hour ago, and that the child in the cradle would have been burnt to death only for Master Harry: not

a soul was near the house but he when the flames broke out, grandmother told me. She was gone to the wood to pick sticks—mother was at the Castle—Betty had just runned out, I can't say where—”

“Oh, never mind that, tell me about my brother,” cried Lucy.

“I can't, miss, for I don't know no more than that he is badly burned. I saw his father carrying of him home.”

“*Carrying* him! then it must be bad indeed,” thought Lucy.

She asked no further questions, but set off running home as fast as she could. Want of breath forced her soon to slacken her speed, and the boy, overtaking her, begged her not to be so much terrified.

“I cannot think Master Harry is *very* badly hurt, because he spoke quite like hisself—strong and cheerful—and his face is not burned, miss, that I am clear sure of, for I saw it quite plain, as he turned his head back over his father's shoulder, beckoning to me, and sent me off with his love to you, miss, and to beg you would not be frightened, which I had not time to tell you.”

Lucy ran on while the boy was saying this: she felt as if she could not get on fast, do what she would: at last she reached the house, and made her way through the people who were stand

ing in the passage. She tried softly to open the door of her mother's room, where she heard that Harry was, but it was fastened : her father from within opened it, inquiring eagerly if a messenger he had sent to the apothecary's in the village had returned.

“ Here he comes,” said Lucy, “ with a bottle in his hand.”

Her father seized the bottle, asking if the surgeon was coming.

No, he was gone to a patient ten miles off, and would not be back till morning.

Her father had not seen Lucy, but she caught hold of his arm, and asked if she might see Harry ?

“ Yes ; you can help your mother. But can you command yourself, Lucy ? Do not come in, if you cannot—”

“ I can— I will—” said Lucy. “ Only tell me what I can do for him ;” and, throwing off her bonnet and gloves, she went in. It was worse than she expected. When she heard groans from Harry, who bore pain so well, she knew he must suffer dreadfully : going nearer, she saw him lying on his side, the arm down to the elbow covered with huge white blisters, or in some places raw, and of a fiery red, his whole frame writhing about in agony ! Lucy could not help shrinking at this sight, but she made no exclamation. She looked at her mother to inquire what could be done :

Her mother was wetting some soft linen rags with spirits of turpentine, which her father poured out of the bottle. These were gently laid on the inflamed parts of the arm, taking great care not to break the blisters. Lucy could scarcely bear to see it done—the least touch gave Harry such torture, even with all his mother's care and delicacy of hand. She was now desired to take her mother's place, and to keep the linen on Harry's arm and shoulder wet with the turpentine. Lucy's hands trembled when she began, but they soon became more steady; the consciousness that what she was doing would relieve her brother gave her courage. To her unspeakable satisfaction, his groans became less frequent; in a few minutes his features, which had been all drawn up, came to themselves; and, opening his eyes for a moment, he looked up at Lucy, and said, "Thank you, dear Lucy."

His father and mother were employed in melting basilicon ointment, and mixing it with the oil of turpentine, in a small saucepan; a process that required great caution to prevent the vapour of that very inflammable oil from taking fire. This preparation was now ready. His mother, with a soft feather, smeared it over the whole surface of the wound, and then spread the rest of it on a large rag, which she gently laid over all. Scarcely was the operation finished, when Harry's

head sunk upon his pillow, and he dropped asleep : this was in about fifteen minutes from the first application of the turpentine.

Lucy left the room, by her mother's desire, to go to bed ; and, as she was moving very softly through the passage, she found Dame Peyton sitting there, waiting for some account of Harry. When she heard that he was easy, and asleep, she went away repeating—

“ Bless him ! God bless him ! ”

For some days Harry was so feverish, that the surgeon had forbidden all conversation in his room ; but at last he was allowed to talk *a little*, and Lucy being most anxious to hear how the accident had happened, she said, “ I left you, Harry, when you were going to work at the steps. Go on from that.”

He had been at work, he said, very busily finishing those steps, and, growing warm, had thrown off his coat, when suddenly observing a great light over the trees, near Dame Peyton's cottage, he went up the bank, and saw flames coming from the roof : he ran on to the house—the house door was locked—he knocked and called in vain, but, hearing the cries of the child, he broke the fastening of a lattice-window, and sprung into the kitchen ; thick smoke almost blinded him ; the cries came from the little parlour, and feeling along the wall, he was partly guided by

them, till these were overpowered by loud yells, which burst out in some place over his head. He found the parlour-door, but it stuck so fast that he could not push it open. He heard the rustling of the flames—he pushed again with all his force, and the door gave way. Fire-light now glared upon him from the roof; Harry saw the cradle at the opposite side of the room; he snatched up the infant, and made his way back through the suffocating smoke and pieces of blazing thatch, which were now falling. He put the infant out first: in jumping after it, he perceived something on fire about himself, and, when he came into the air, he found his shirt-sleeve in a blaze; he threw himself on the ground, in hopes to extinguish the flame; but as fast as he extinguished it in one place, it appeared in another. No help was near. The pain was intense!

This was all Harry could tell of what had happened, till he awakened again, as he described it, and heard a confusion of voices, and found himself in his father's arms.

Dame Peyton had come morning, noon, and night to inquire how he was, and very much wished to see him. He was now able in Lucy's opinion, and in his own, to see her, and Lucy admitted both the dame and the mother of the child, who were anxiously waiting at the door. The mother softly approached his bed-side, with her infant in

her arms, judiciously considering that no sight could be more gratifying to Harry. Their thanks were silent—the tears came into their eyes as they looked at him, and Dame Peyton uttered one low and fervent “God bless him!”—not a word more. Even Harry, with his horror of flattery, and dread of being thanked, was pleased; especially when the infant stretched out its little arms towards him, and smiled.

Harry asked if they had found out what the yells came from which he had heard in the loft?

The dame told him that they came from her cat, which had been burned there with its kittens.

He then wished to know if the whole of the new roof had been burned, and how it had caught fire.

Yes, the roof was all burned, but not much other damage had been done. How the house first took fire no one could tell. Betsy declared that all was safe when she went out;—no clothes—nothing left near the fire-place, and the fire was very low. As far as they could judge, the fire had broken out in the loft.

Harry thought that perhaps the chimney might have some crack in it; but, no, it had been examined, and Dame Peyton repeated, that it was most extraordinary that a fire should break out in a loft when nobody had been in it, or so much as up the stairs that led to it, for two days before—of this

Betsy and she were certain. No creature had been up there.

“Except the cat,” as Lucy observed. It just occurred to her, that the dame’s favourite tabby cat had been the cause of all the mischief. Lucy recollected to have often seen her lying in the ashes almost under the grate. She thought it possible that tabby had gone up to her kittens in the loft, with a bit of cinder sticking to her, which might have set fire to the straw in which she and her kittens were lying.

This seemed very likely to all but Dame Peyton, who could not bear that the blame should be brought home to her poor dear tabby. In zeal for the memory of the best of cats, Dame Peyton forgot the under-tone proper to a sick room, and she was in loud demonstration of the impossibility of that which probably had happened, when the door opened, and the surgeon entered. The room was cleared instantly. Even Lucy, notwithstanding her protestations of innocence and promises of perpetual silence, found herself in the passage, and the door closed against her.

The surgeon pronounced that Harry had still much fever; and he found, that, though the burn was rapidly healing, yet his patient could not raise himself, nor turn in his bed without much pain. Upon further examination the surgeon discovered that Harry had received a severe strain, the con-

sequences of which might, he said, be very serious. He feared that it would be necessary for Harry to continue confined to an horizontal position for some time.

“How long, sir?” said Harry, in an intrepid tone.

As far as the surgeon could guess, it would probably be some weeks before Harry could walk. He might attempt it sooner, but, if he did, it would be at a great risk; on the contrary, if he submitted quietly and steadily to this confinement, in all human probability he would perfectly recover, and be as well and active as ever.

The moment he was convinced of the reason and necessity of the case, Harry was perfectly submissive, and better than submissive—resolute to bear and forbear whatever was prescribed. When the surgeon had left the room, Harry looking up, and seeing his mother’s anxious eyes fixed upon him, smiled, and said, “Do not be afraid *for* me, or *of* me, mother; you shall see how good and how well I shall be: a few weeks will soon be over; and, though I am to lie flat, I may use my hands and arms, I suppose, as soon as my burn is well; and I can read and entertain myself, and, what is better, I shall have Lucy to read to me, and talk to me. You need not pity me, mother, I am not to be pitied at all. Was not it very fortunate that I was there, and in time

to save the child? Think of the delight I felt when I got it safe out of the window, and the joy of hearing it squall again, of being certain it was alive! I am sure that, and the pleasure I have just had in seeing the mother and child, and the old woman too, are enough to pay me for all. The surgeon, you know, said we might thank God it was no worse, and I thank God it is so well. Think, mother, of my having been the means of saving a fellow-creature. I am sure I do, with all my heart and soul, thank God."

After all this excitement, his nurses wisely left him to repose. He fell into a sound sleep. How long he might have slept none can tell, for he was wakened, much to Lucy's provocation, by a loud knock at the hall-door. It was Sir Rupert Digby—not he, surely, that gave the thundering knock; no, that was his fool of a groom, for even wise men sometimes have foolish grooms.

Sir Rupert Digby was allowed to come into Harry's room, and Lucy was struck by the melancholy expression of his countenance, which did not clear up when Harry's own cheerful voice assured him that he now suffered but little, and that he hoped to be quite well in a few weeks, and able to go to Digby Castle; at these words Sir Rupert shook his head sorrowfully, and said—

"We shall not be there to meet you, my dear.

We are obliged to set out immediately for the Continent."

One of Lady Digby's nieces, as they had heard this morning, had been taken dangerously ill, and they were going to her. This was a farewell visit from Sir Rupert. Lady Digby could not come—she was too busy, and too unhappy.

Harry and Lucy were very sorry, but they were not so selfish as to think much of their own little disappointment, and Harry was grateful to Sir Rupert for thinking of him at such a time. Sir Rupert had indeed thought of everything that could contribute to Harry's ease and comfort in his absence, and now offered the key of his library, and the use of his prints and instruments, which were most gladly accepted.

Sir Rupert promised not only to write to Harry's father, but to Harry himself, if he should see anything on the Continent that he thought might amuse or instruct him.

"Farewell, Harry," said he. "May God bless you, and keep alive in your mind the benevolent feelings you possess, and the noble desire to improve the faculties with which He has endowed you."

P L U M S.

DURING some succeeding days Harry's pulse and his own account of himself were at perpetual variance: he asserting that he was well, quite well, while his pulse pronounced morning and evening the reverse. The surgeon preferred the report of the pulse; and Harry, bound by his wise resolutions, was obliged to submit to Doctor Diet and Doctor Quiet, and to have nothing yet to do with Lucy's favourite, Doctor Merryman. Harry was neither to talk nor to be talked to; neither to read nor to be read to; neither to entertain nor be entertained. Lucy, with a face becoming the most discreet of little nurses, sat by his bed-side, knitting for him future *comfortables*, or went about in silence, but never on tip-toe, for that Harry detested; he always wakened when any one went on tip-toe; but moving quietly, yet without any appearance of constraint, she freed him from the fear of keeping her prisoner. In about a fortnight his arm healed; but, from the effects of the strain, he was still obliged to be a prisoner upon the sofa: for some hours lying, as required, quite flat; at

others, raised from that tiresome horizontal penance to a position which, with all the advantage of rest, restored him to the use of hands, arms, and eyes. This privilege he owed to the kindness of his friend Sir Rupert, who, in passing through London, saw and sent him a bed, invaluable to all in his condition

The first day it came, Harry begged that it might be placed in his view, so that he might examine its construction. He saw that the bedstead was hinged in the middle, and that either end could be sloped to any angle that was desired, and firmly fixed there by a supporting frame, just, as Lucy said, like her music desk. There were various other contrivances which delighted Harry; first as a mechanic, and then as an invalid. He had himself raised and lowered till he found the angle which was most easy and convenient. Then Lucy was employed to make a pasteboard quadrant, and to fasten it on the side of the bed-frame, so that he could most accurately, as she said, signify to her his *inclinations*. “You must allow me that pun, Harry.”

He allowed it to her in consideration of her well-divided quadrant. To say the truth, the quadrant was found of little use. It was easier to say, “Put me up to the third notch, or to the fifth notch,” as the case might require. But it is natural to ingenious people, especially when young, to make

use of superfluous inventions upon common occasions.

Lucy more than ever rejoiced at having acquired some taste for Harry's pursuits; because, as she had been his best little nurse when he was sick, so now she could be his most agreeable companion while he was recovering.

Established on this most convenient of beds, his next object was to add to it a reading and writing-desk, which, in its kind, he determined should be as perfect as the bed. Sundry trials were made sundry ways, and at last a desk was contrived by Harry, and executed by the carpenter, which was perfectly firm, and yet removable at a moment's warning, ceding its place to the dinner, breakfast, or tea-tray.

It is but justice to Harry to mention, that, before he thought of all these conveniences in his own establishment, he had been intent upon getting the roof repaired for Dame Peyton.

Sir Rupert had placed his carpenter under Harry's orders, and had agreed to his request, that the house was now to be slated. Harry looked at his old plan again; and, with his father's concurrence, made some improvements in this second edition of his roof. When the ingenious and admirable machinery of Mr. Brunel was a few years ago burnt to the ground, he replied, to a letter of condolence, that he found suffi-

cient consolation in the hopes of materially improving it.

As soon as the surgeon's permission was obtained, Harry had great enjoyment in the books which his mother brought for him from Digby Castle: among these were Scott's poetical works. Harry formerly thought he had no taste for poetry; but now, when his mother read to him the beginning of the "Lay of the Last Minstrel," he felt surprised at being so much pleased with it, as much even as Lucy. His mother having refused to let him hear more than one canto the first evening, he looked forward with eagerness to the time when her reading was to recommence. This now appeared the most delightful hour of the whole day; and, but for the shame of not allowing his mother time to take breath, Lucy and he would willingly have listened to canto after canto, and poem after poem, from the "Lay of the Last Minstrel" to the "Lord of the Isles."

But his mother managed their pleasures so that they not only lasted the longer, but were relished the more keenly—not swallowed without being tasted. Lucy had this art yet to learn.

"Mamma," said she, "I think you are too careful not to tire him with reading; I think he cannot have too much entertainment. It is only the stupid parts of books which tire one. All that is necessary is to pick out the plums, and to have a variety."

“He would, I think, be soon tired of plums, my dear,” said her mother, “and a great variety would weary him still more.”

“Well, mamma,” whispered Lucy, “will you let us try the experiment? I should like to see whether he could be tired of plums. I will pick out what I know he likes best, and never give him too much of one thing at a time—you will see, mamma.”

“Try, my dear, and you will see,” said her mother.

Harry had now recovered sufficiently to resume some of his usual employments; and he begged Lucy one day to bring Euclid, that he might take his morning half-hour at geometry before they did anything else. Lucy was of opinion that he ought not yet to read anything so very serious. When the surgeon came, Lucy extorted a similar opinion from him, and therefore determined next day to try her experiment. Accordingly, at the hour which Harry had set apart for his mathematics, she stole in softly behind him, and, while in the midst of the square of the hypotenuse, she laid beside him a fine large butterfly, who in the most obliging manner rested there with outspread wings.

“I will look at it in one instant,” said Harry, as Lucy called upon him to admire the beautiful purple eyes on the wings. “Only just wait one moment till I come to the Q. E. D.”

But, as he spoke, the butterfly made a little motion, as if preparing to rise.

“Take care that it does not fly away,” cried Harry.

“There is no danger,” said Lucy.

In another instant, before Harry came to his Q. E. D., the butterfly made a sudden jump up, and alighted upon Harry’s hand. He started when he felt its cold tail and bony body. It was no butterfly, but a sort of skip-jack. Lucy had been at work painting the wings from sunrise ; and, for all the labour bestowed on the feather-cinctured head and proboscis, she was overpaid by this start of Harry’s. Emboldened by her first success this morning, she closed Euclid decidedly, and drew it from Harry’s hands.

“Harry,” said she, “for the rest of this day you shall have nothing but plums, and I have plenty in store for you of all sorts. You will not, I hope, be above feasting on such pretty and good ones as I have here for you ;” and she laid down a basket full of books, in each of which there were various paper marks.

“I am not above anything good or pretty,” said Harry ; “but I think it is too early in the morning : if you begin now, you will scarcely be able to supply me all day long.”

“Try and we shall see, as mamma says.”

“Besides,” continued Harry, “I think plums all day long would make anybody sick.”

“No, no,” said Lucy, “you shall have such variety—only trust to me; give me leave to entertain you all this day, Harry, will you?”

Let those who have tried the experiment say, which has the hardest part, he who undertakes to entertain, or to be entertained all day long. Lucy had made a good beginning however, having got rid of Euclid with her butterfly. From her butterfly she went on to the “Butterfly’s Ball,” and the “Grasshopper’s Feast,” and the delightful “Peacock at Home.” By some strange chance Harry had not yet become acquainted with them.

“Mamma told me,” said Lucy, “that this little book has had the honour of being quoted by a great man in the House of Commons. These are the lines he repeated:

“For birds are like men in their contests together,
And in questions of right can dispute for a feather.”

“But there is the breakfast bell,” said Lucy, interrupting herself, “I must go for your breakfast.” Having set it before him in order due—“Now I must leave you for a few minutes, while I eat my own; but I shall soon return to feed you with plums.” Upon her return, Lucy brought up the newspaper, which contained an extract of a letter from Sir Thomas Stamford Raffles, late governor of Sumatra, giving an account of the loss of the ship *Fame*. After describing the alarm

excited by the cry of "Fire," and the hurry with which Lady Raffles and her children were thrust into a boat, he says—

"All this passed much quicker than I can write it—we pushed off as the flames were issuing from our cabins. The masts and sails now taking fire, we moved to a distance sufficient to avoid the immediate explosion, but the flames were coming out of the main hatchway, and seeing the rest of the crew with the captain, &c., still on board, we pulled back to the ship. As we approached we perceived that the people were getting into a boat; we hailed her—'Have you all on board?'—'Yes, all save one; Johnson, sick in his cot.'—'Can we save him?'—'No, impossible.' At this moment, the poor fellow, scorched I imagine by the flames, roared out most lustily, having run upon deck. 'I will go for him,' says the Captain. He pulled under the bowsprit of the ship and picked the poor fellow up—'All lives safe, thank God! Pull off from the ship.' We then hauled the boats close to each other, and found the captain fortunately had a compass. Our only chance was to regain Bencoolen; and the captain undertook to lead, no possibility being left that we could again approach the ship, for she was now one splendid flame, fore and aft and aloft; her masts and sails in a blaze, and rocking to and fro. The alarm had been given about twenty minutes past eight, and in less than ten minutes she was in flames; there was not a soul on board at half past eight, and in ten minutes afterwards she was one grand mass of fire.

"Without a drop of water, or a grain of food, or a rag of covering, except what we happened at that moment to have on our backs, we had embarked on the wide ocean, thankful to God for his mercies. Poor Sophia, having been taken out of her bed, had nothing on but a wrapper, neither shoes nor stockings; one of the children had been snatched out of his bed after the flames had attacked it—in short, there was not time for any one to think of more than two things: Can the ship be saved?—No—Let us save ourselves then; all else was swallowed up in one

great ruin. The ship continued to burn till about midnight, when the saltpetre, of which she had 250 tons on board, took fire, and sent up one of the most splendid and brilliant flames that was ever seen, illumining the horizon to an extent of not less than fifty miles, and casting that kind of blue light over us, which is of all others most luridly horrible. Rain now came on, but fortunately it was not of long continuance, and the night became serene and starlight. The men behaved manfully; they rowed incessantly, and never did poor mortals look out more anxiously for daylight and for land than we did; not that our sufferings were anything to what has often befallen others. About two o'clock we landed safely, and no words of mine can do justice to the expression of sympathy and kindness with which we were hailed by every one. If any proof had been wanting that my administration had been satisfactory, here we had it unequivocally from all. There was not a dry eye, and, as we drove back to our former home, loud was the cry of 'God be praised!'

"The property which I have lost, on the most moderate estimate, cannot be less than £20,000. But the loss which I have to regret beyond all is my papers and drawings; including my notes and observations, with memoirs and grammars, dictionaries and vocabularies; and a grand map of Sumatra, on which I had been employed since my first arrival here. This however was not all—all my collections in natural history, and my splendid collection of drawings, upwards of a thousand in number! And, to conclude, I will merely notice, that there was scarce an unknown animal, bird, beast, or fish, or an interesting plant, which we had not on board. A living tapir, a new species of tiger, splendid pheasants, &c., &c., all *domesticated* for the voyage. We were in short a perfect Noah's ark: all, all, has perished; but, thank God! our lives have been spared, and we do not repine."

Harry was as much interested by this as Lucy had expected—he admired the activity and cou-

rage displayed by these sufferers during the moment of danger; and observed to his sister, that the kindness with which Sir Stamford was welcomed on shore showed what a good governor he had been. He looked again at the account, and, while Lucy and he were considering for which of the losses they were most sorry, Lucy exclaimed, "Hark! a knock at the door; that is to tell me that my magnum bonum plum is ready, and you shall have it."

She opened the door and received from the hands of the servant Harry's camera obscura, in which, with her father's assistance, she had fixed the new glass. Lucy had prepared everything; she had a stand ready, so that Harry could see and enjoy it completely. He did enjoy it as much as she could have expected: his eye was fixed upon the landscape which he saw before him; and he admired the quiet cattle slowly moving on the paper, and the winding path, and the fresh green trees, with their light boughs dancing in the sunshine.

While Harry was looking at them and considering what he saw before him, Lucy exclaimed, "I know what you are thinking of, Harry, of the coloured shadows we used to see on the wall of our room at home."

She darted out of the room, and returned with a quarto volume. "Now, Harry," cried she, "for

blue shadows and green ! black shadows and red !
I will read you all about them."

She sat down and read—

"It is rather remarkable that so curious an appearance as this of blue shadows should pass unnoticed near a century, and should then be hit upon by mere accident. Buffon, as he was busy about something else, observed that the shadows of trees which fell upon a white wall were green."

Here Lucy read a curious but long account of his observations upon green and indigo shadows, seen in different circumstances, ending with, "any person may see a blue shadow, if he will only hold his finger before a piece of white paper at sunrise or sunset."

Harry said he should like to try this.

"Is it not all very entertaining?" asked Lucy.

"Very," said Harry, "but is there not some explanation given? What is the cause of the different colours of these shadows?"

"There is a great deal about it in this book," replied Lucy, "and the history of a great many experiments, which different people have tried."

"Let me see," said Harry, stretching out his hand for the book.

"No, no," said Lucy, "they would be too difficult for you *now*—besides, they would not be plums, and you are to have nothing else to-day—

I will put a mark in the place for you, and you may study coloured shadows another time."

Lucy then turned over the pages quickly to find a favorite anecdote about a poor old woman who lived at Montpelier: but in her search for the old woman she was stopped on her way by an account of a prodigious rainbow lying on the ground, its colours almost as lively as any ever seen in the heavens. She chased the rainbow into a chapter infinitely too deep for her comprehension, and found herself in the midst of single, double, and treble bows, and inverted bows; in company with Sir Isaac Newton and Bernoulli one minute, the next with M. Bouguer on the mountains of Peru, or Dr. Halley in Chester, till neither she nor Harry could tell where she was. She abandoned her chase of the rainbow, but she stumbled upon her long looked for old woman of Montpelier.

"And what of her?" said Harry "has she anything to say to the rainbow?"

"Nothing in the world, my dear," said Lucy—"quite another thing: she had bought a piece of meat one day in the market, and hung it up in her bed-room."

"Dirty old woman!" said Harry.

"Poor old woman!" said Lucy: "and at night (a very hot night it was) she saw on this meat, which was hanging opposite to the foot of her bed—

what do you think?—a bright light, so bright as to illuminate the wall. The next day this luminous meat, which she thought was bewitched, was carried to Henry Bourbon, Duke of Condé, the governor of the place, who viewed it with astonishment for some hours !”

Some hours ! Harry thought that was too much, though he would gladly have been allowed to pause upon it for a few minutes. The light, as he guessed, was phosphoric, and he reminded Lucy of a shining light which they had once seen in the shell of a decayed lobster ; but Lucy rapidly turned over to a new page, with an account of some experiments which Boyle tried on phosphoric substances, placed in the air-pump. Then she went on to a story of Doctor Beale’s cook, who was boiling some mackarel, and saw the fish and the water shining as if on fire, and the children of the family diverting themselves by running about the house with the luminous drops, which were as large as penny-pieces—“ Think of that, Harry.”

She then ran on to Father Bourze’s voyage to the East Indies, during which he noticed a wonderful luminous appearance in the sea, by which he could read in the night.

Harry wished to know whether it proceeded from putrescent substances or from luminous insects. He asked Lucy if she recollected having heard a captain in the navy, a friend of his father’s,

say, that he had brought to England, and given to Sir Joseph Banks, some luminous animals, three inches long, which he had taken up from the Southern Ocean, and which gave so strong a light, that he could read a very small print by one of them, which he had put in a bucket of salt water.

Lucy could not spare time to answer — she wanted to read what would entertain him, as she hoped, more than any luminous insects.

“The Bolognian stone! Harry, did you ever hear of this stone, which gives light in the dark?” and she read on for some pages, till she recollected quite a different thing, which she was sure would amuse Harry still more; and, throwing aside that book, she took up a description of the Esquimaux houses, built of blocks of snow, with well-turned domes, and with windows of thin ice. This interested Harry very much; but, as Lucy thought that he began to look a little tired, she hurried him out of the house of snow, and read some anecdotes of the Esquimaux lady, Illigluk, who understood maps, and drew charts so well, but whose head not being able to bear the praises of the English sailors, she became so conceited and affected, that she could do nothing but sit in her chair on deck, practising her airs.

Lucy again changed to something new, and travelled from the North Pole to Chili, and from Chili to Grand Cairo and the Pacha, and read

the account of his delight in seeing ice, made in an air-pump, by the English Consul; and in this manner she went on almost all the morning, flying from one book to another. Whenever she thought she saw fatigue in Harry's face, she turned to a fresh subject, still fancying that by variety of entertainment she should revive his attention, and please him more and more; but at last, observing his head resting on his hand, she stopped short and said, "Oh! Harry, does your head ache?"

Harry confessed it was beginning to ache a little.

"I am very, very sorry," said Lucy. "Why did you not tell me sooner that you were tired?"

"I did not know it till my head began to ache," said Harry.

"I thought I was amusing you all the time," said Lucy. "You told me that everything I read was very entertaining."

"So each thing was," said Harry, feeling for her disappointment, "but altogether they—"

"My dear Harry, say no more," said Lucy sorrowfully; and, settling his cushions, she added, "There, lay down your poor head now, and I will go away to mamma."

Harry was so much worn out, that Lucy was not allowed to see him all the rest of the morning, and, as she wished her mother good night, she said, "I see you were quite right, mamma, I tired Harry with plums long before the end of the day."

HAPPY ILLNESS.

“My dear Harry, how do you do this morning?” said Lucy, coming in with a timid step and contrite look.

“Very well!” cried Harry, briskly, “perfectly well, thank you.”

“You have no reason to thank me,” said Lucy, “for giving you the headache.”

“But my headache is gone now, and it was a good experiment, after all.”

“A bad experiment for you, I think, but good for me,” said Lucy; “for now I am convinced for life that plums all day long will never do, let them be ever so sweet and well-picked—that mine were well-picked, you will acknowledge, Harry. Did you sleep well?”

“Yes,” said Harry, “and wakened this morning as fresh as ever, and then I spent my time very happily in thinking.”

“That is what I do sometimes, when I waken early,” said Lucy, “and I think of a hundred different things, till I do not know what I am thinking of, and fall asleep again. Was that the way?”

“No,” said Harry, “that was not the way with me, for I was thinking only of one thing.”

“What was that?” asked Lucy.

Harry hesitated—“I should like to tell you, Lucy, but perhaps it might vex you.”

“Oh! no,” said Lucy, “you cannot vex me, I am sure.”

“Well, then, I was considering why I was so much tired yesterday; and I think I have found it out—shall I tell you?”

A cloud passed over Lucy’s brow. At this moment her mother came in with Harry’s breakfast. “Do you think, mamma,” said Lucy, “there could be any use in Harry’s going all over what passed yesterday, to tell me how I tired him so much? You know I am quite convinced of my mistake.”

“I am sure of that,” said Harry, “but there were many reasons why I was so tired; I did not know them all myself, till I thought over the whole affair this morning, and it may be of use to you to know them.”

“I do not see much use,” said Lucy. “What do you say, mamma?”

“I say that Harry had better eat his breakfast first, and that afterwards, as the object of a kind sister and good nurse must be to entertain without fatiguing your patient, you had better listen to his reasons.”

“Well, mamma,” said Lucy, “as I do wish to be a good nurse, I will ask him for them as soon as he has done breakfast.”

Accordingly, the breakfast being despatched, Harry began with the comfortable words, “I will be as short as I can. In the first place, you know that my mind cannot turn short round, like a crane-necked carriage, whenever and wherever you please : yours can, Lucy. Therefore it was more difficult to me than it was to you to turn so frequently from one thing to another, from coloured shadows to luminous insects, and from the old woman at Montpelier to Ali Pacha. But, besides this, I was continually disappointed ; and you know, Lucy, disappointment tires.”

“Oh yes, I allow that,” said Lucy ; “I felt tired yesterday myself, the moment I was disappointed in my hopes of entertaining you : but how were you disappointed and continually too ? What do you mean ?”

“I mean, that, when my interest was excited by anything you read to me, I was disappointed in not having time to understand it completely.”

“I know it would have tired *me* much more,” said Lucy, “if I had been obliged to study everything to the end of the chapter.”

“I think not,” said Harry. “I think, Lucy,

we are always better satisfied when we get to the bottom of one thing before we fly off to another."

"I am afraid that is not always my case," said Lucy; "but, at all events, it would not have been good for you to have gone on with Euclid all day long."

"Probably not," said Harry; "but I have still another reason for you. All the time you were reading, I was anxious; and I am sure anxiety tires, as much as disappointment."

"But what anxiety had you?" asked Lucy.

"I was anxious not to be tired, while you were trying all you could to entertain me; and the more I wished this, the more weary I grew."

"And that was the very thing," said Lucy, "that made me hurry on from one thing to another, for I thought sometimes you looked fatigued. But still, Harry, you see it was not the plums alone: you were tired because you were disappointed and anxious."

"Yes," said Harry, "but the plums in themselves would have been too much. In time, one grows tired of being entertained."

"Would it then mend the matter to read tiresome things between the entertaining ones?" said Lucy.

"I am not sure but it would," replied Harry. Lucy laughed. "I mean," continued Harry, "if the tiresome things are worth reading; for tire-

some things often leave useful impressions behind them ; besides, there is a pride in getting through them, and, if there is any difficulty, we have the pleasure of success."

" I agree to that," said Lucy ; " a little success, or a little bit of praise, refreshes me very much. And I think, Harry, you will allow that you are not tired now ; for I am sure you have got to the bottom of this subject."

Harry was this day to arrange his occupations and amusements in his own way. While Lucy went out, he applied to Euclid for half an hour, that he might, as he said, earn an appetite for a story which he knew Lucy had in store for him—" Nourjahad." He stopped her at Nourjahad's first sleep of a hundred years, at a moment when he was very curious to know what would come next—what would happen when he awakened. Then he went to a translation of a passage in Euripides, which he said he would prepare for his father ; after working at that for some time, he amused himself with the " Shipwreck of the Winterton," in which he was much interested ; but his father coming in, an hour was spent between Greek and English tolerably successfully, and therefore without fatigue. The next hour was spent in trying to complete an invention, which he had long had in contemplation. Lucy went to her own affairs while he was thus occupied,

and promised to return in half an hour ; but at the end of this time, when she appeared, he told her she might stay away another half hour ; and then she found him looking very much tired, for he had not been successful in his invention, and he had persisted in thinking of it too long. He was however refreshed by some more of "Nourjahad," in which he was very happily engaged, when Lucy was summoned by the sound of the dressing-bell. Looking at each other, they both exclaimed, "So soon !"

We cannot pretend to say that on the following days Harry was always equally successful in arranging his occupations, so that "labour and rest should equal periods keep." Much greater philosophers than he daily fail in this attempt, and Harry, it seems, was not always so great a philosopher as he thought himself. Though he had been very grand in resisting the temptation of reading too much of "Nourjahad" at once, yet one day temptation came, which he could not resist, in the form of "Baron Trenck's Memoirs." Lucy began to read it to him after his morning's mathematics ; but, after reading an hour, she observed that it was time to go to her garden. Harry intreated her to go on half an hour longer, if she was not tired. "Not in the least," said Lucy, "I am only afraid of tiring you." Half an hour—an hour longer she went on, and then she left

him to repose ; but no repose could Harry take, he was so anxious to know whether the first hole that Baron Trenck made in his dungeon wall was discovered by his jailor. He eyed the book, which Lucy had left on the table, as she thought, out of his reach ; but, with the aid of a pair of lazy-tongs, he drew the tempting volume to him, and never stopped till it was finished. Lucy coming in, he asked her voraciously for the second volume. She was astonished at his having already devoured the first, and demurred, but soon yielded to his imploring emphasis on the persuasive little word, "*Do* let me have it, my dear." In short, the whole day was spent upon it. When he had finished, he felt as if there was a universal blank in the world. Nothing could interest him after this strong stimulus, and in the evening he was obliged to acknowledge that he was "very much tired indeed."

Lucy demurely observed, and Harry readily agreed with her, that we may tire ourselves as much by going on too long with one entertaining thing, as by flying about to a variety.

It must be said on behalf of Harry, that his confinement to the sofa rendered it somewhat difficult for him to get through the day without fatigue of mind, because he was debarred from that kind of labour of body which we call exercise, and which is found most useful in restoring the

freshness of the spirits. Lucy's power of making him laugh had been often found the best substitute for bodily exertion; and she again satisfactorily proved, that "Laughter holding both his sides" takes and gives exercise in the most salutary manner.

"Mamma," said Lucy, when they had done laughing, "it was very well worth while to listen that day to Harry's reasons; I have not tired him so much since."

"Never," cried Harry. "Indeed, she has often hindered me from tiring myself."

"And do you know, mamma," continued Lucy, "he can do much more in the day now than he could before, because we have arranged it rightly."

Harry observed, that they had been obliged to try a great many experiments before they had brought things to this happy conclusion.

"You see, mamma," said Lucy, "that Harry must have experiments some way or other: and now that he has neither balloons, nor workshop, nor laboratory, and cannot stir from his sofa, he is reduced to try them on his own mind or on mine."

"And that is very convenient," said Harry, "for we have all we want for the purpose in ourselves. Mother, do not you think it is useful?"

"Very useful, my dear, for by these means you

may learn to command your own mind, while at the same time you are acquiring some insight into the minds of others: and, by judiciously arranging your occupations, you may not only get more done in the same period, but you may strengthen, quicken, and enlarge all the powers of your understanding."

ENIGMAS.

HARRY was now well enough to be brought out into the common sitting-room. His sofa had large castors, which moved so easily, that Lucy, without any help, could roll him from room to room. One evening she was admiring these castors, and Harry, who had not failed to examine their construction, undertook to explain to her on what their excellence depended. He told her, that in common castors the upright pin, round which they turn, is so short that it has no support, being only just long enough to rivet through the lower plate of the brass socket ; but that in these castors the pin is five or six inches long, and tapered to the upper end, which is made to play in a little iron thimble let into the leg of the sofa. “ So that you see, Lucy, the long pin is always kept in its place ; and, as it turns round with very little friction, it allows the wheel to take at once the direction in which the leg is moving.”

His father remarked, that castors on the same principle were now sold, as a recent invention, by the name of French castors, though a print of a similar contrivance is to be found in a Dutch book on windmills, printed above a hundred years ago.

“In this trivial circumstance, Harry, is an example of what I have often observed to you, that the same things are invented in different countries, by people who have no communication with each other; simply because the same wants are felt, and because the same progress has been made in knowledge. Indeed these very castors were invented and used by a friend of mine in this kingdom thirty years ago, and yet I can readily believe that some Frenchman may have again re-invented them still more lately.”

“But if your friend invented them first,” said Harry, “I think it is wrong that they should be called *French* castors.”

“It is not worth while for nations or individuals to dispute about such trifles, my dear boy,” said his father; “no persons, who have much invention, are meanly anxious to contest, on every petty occasion, their claims to originality. Their feeling is—Better invent something new than dispute about the past.”

Here the conversation was interrupted by the arrival of a lady, who was to drink tea with them. When tea was over, she produced from her work-bag a little manuscript book, containing a collection of riddles and charades, which she had brought for Harry’s amusement. Lucy liked them, because she found them out quickly. Harry was uncommonly slow and unsuccessful in his at-

tempts; even hints, intended to help him, invariably set him more wrong. He soon came to "pray tell me," and, when told, he could not always understand the explanations; they appeared more difficult than the riddles themselves, especially when both Lucy and the lady were explaining them to him at once, and in different ways. However, he was so good-humoured, and afforded so much diversion by his strange guesses and extraordinary misapprehensions, that their visitor, as she closed her book, declared, that for her part she should have been quite sorry if he had made them out better. Of six or seven special favourites she left copies with Lucy; and, after her departure, Harry begged Lucy to go over these again with him one by one. If he had ever known, he had by this time forgotten, their meaning: so that they were to be guessed by him again, with Lucy's assistance.

"First," said Lucy, "comes a riddle.

"You eat me, you drink me, deny it who can;
I'm sometimes a woman and sometimes a man."

"I'm sometimes a woman and sometimes a man," repeated Harry, "and yet you are eaten! Only cannibals eat men and women; and yet this cannot be a cannibal—you may as well tell me at once Lucy, for I cannot find it out."

"Then it is a *toast*," said Lucy; "you eat a toast, and you drink a toast, do not you? and

sometimes a woman is a toast, and sometimes a man—deny it who can.”

Harry could not deny it ; but he observed it was a play upon the different meanings of the word.

“ Yes, and a happy play,” said Lucy.

“ Happy for you who found it out,” said Harry. “ Well, I have now some notion how to set to work. I shall look in the next for a play upon the words. Now for number two,” which he read accordingly with his usual deliberation.

“ I’m Latin, I’m English,
Both one and the other :
But the Latin of one half
Is English for t’other.”

But neither Latin nor English half could he make out ; and, when Lucy told him it was a *toad*, it was a considerable time before he could divide toad into *to* and *ad*, or comprehend that *ad* being Latin for *to*, and each word being composed of two letters, the terms of the problem were exactly fulfilled. He acknowledged that it was a shame for him not to have found out this, as his Latin should have helped him ; but he sheltered himself under the change of pronunciation in both words. Lucy told him, that such little variations of sound must be allowed, or there would be no getting on with riddles.

“ Very well. I will make allowance another

time, and that will help me, I hope, to make out number three.

“Inscrib’d on many a learned page,
In mystic characters and sage,
Long time my first has stood :
And, though its golden age be past,
In wooden walls it yet may last,
Till clothed in flesh and blood.

“My second is a glorious prize,
For all who love their wondering eyes
With curious sights to pamper :
But, should they chance this prize to meet,
All’ improvise in the street,
Oh, how ’twould make them scamper !

“My whole’s a sort of wandering throne,
To woman limited alone,
The Salique law reversing ;
But when th’imaginary queen
Prepares to act this novel scene,
Her royal part rehearsing,
O’erturning her presumptuous plan,
Up jumps the old usurper man.”

The lady had said that she believed this riddle was composed by a great statesman, Charles Fox ; and Lucy thought this very likely from his statesmanlike allusion to the Salique law ; but, be it written by whom it might, she thought it very ingenious.

While she was saying all this, Harry was pondering over the manuscript. Lucy advised him to leave *my first* and go on to *my second*, because

he could easily guess what would make anybody run away, if suddenly met in the street, and what would at the same time be a curious sight.

He did make out that this might be a wild beast—a tiger or a lion. Lucy bid him stick to *lion*, and go on to consider what could be a wandering throne for woman—yet a throne which must be enjoyed with the assistance of man. With infinite difficulty, Harry at last guessed a sedan chair. But sedan chair and lion would not make any sort of sense: “therefore,” said Lucy, “remember ‘*up jumps*’ the old usurper man; that may help you:” but all her helps were vain.

“Oh, tell me!” said he, groaning.

“A *pillion*,” said she. He stared and looked blank, till she had repeated it syllabically.

He went back to the pill—“The mystic characters inscribed on many a learned page,” being the physician’s recipe; and the allusions to the old custom of gilding pills, and to their present wooden receptacles, Harry acknowledged to be somewhat ingenious, but he could not pass over the fault in the spelling: there was an *l* too little, if the lion’s share was taken from him to complete the pill. Lucy assured him that he must make some allowance in the spelling, as well as in pronunciation—a kind of *poetical licence* must be given.”

He was willing to give any licence which the laws of riddle-makers allowed: all he asked was, to

know the laws, that he might guide himself by them.

“But the laws will not guide you much, I am afraid,” said Lucy. “Let us go on with the fourth, and we shall see.

“My first doth affliction denote,
Which my second was born to endure,
My whole is a sure antidote
That affliction to soften and cure.”

Harry had no time nor opportunity to puzzle or blunder at this; for his father, hearing the words, exclaimed, “That is *woman*! is it not, Lucy?”—and, addressing himself to her mother, observed, that this charade reminded him of Fontenelle’s just and elegant description of the female sex—

“Ce sexe sans lequel le commencement de la vie serait sans secours—le milieu sans plaisir, et la fin sans consolation.”

Lucy now read number five—

“My first conveys the Irish lass
To Ballyshannon fair;
My second oft contains a mass
Of gold and diamonds rare;
My whole is worn by those I wot
Who gold and diamonds wear—
The Irish lass she wants it not
At Ballyshannon fair.”

Harry gave this up; “for,” said he, “I know nothing about Irish lasses or Ballyshannon fair;

it is quite impossible for me to make this out—so tell it me, Lucy.”

“Carmine.”

“I wot he does not know that use of it,” said his mother.

“I do, mother ; and you do not make that use of it,” answered he, with a knowing smile, “and I am glad you do not. Do you remember, Lucy, that when I was a very little boy, and going my rounds wishing good night, I had to kiss a lady, that shall be nameless, who wears quantities of rouge ? I did not know that, and unfortunately kissed away half her cheek, and left the oddest mark ; I could not help staying to look at it, and she was very angry ; but now go on, Lucy, and read your next, which is so short, that I hope it will be easy—

“The beginning of eternity, the end of time and space,
The beginning of every end, and the end of every place.”

He looked very serious. It sounded so grand, that he fancied it must be something sublime ; and much was he provoked when he was told at last, that what he had been aiming so high to reach was only the letter *e*.

“But you found it out, Lucy,” cried he. “How could you ?”

“I cannot tell,” said she.

“Oh ! do recollect what put it into your head

that it was a letter. What was your first thought?—how did you go on? *Pray* think, Lucy."

Thus urged to it, Lucy did her best to recollect; and after a pause of deep consideration, and snuffing the candles, which did not want snuffing, she said, that at first she thought, as Harry did, that it must be something very sublime; "but its being the end of every place convinced me," said she, "that it could not be anything serious. Then the contradictions—the impossibilities—showed me it could not be any one real thing, except a letter."

"Except a letter! But how did you come to that exception?"

Lucy said she had long ago heard a very pretty enigma upon the letter *h*, beginning—

"'Twas whispered in heaven, 'twas muttered in hell."

She confessed she should never have found it out if she had not heard this.

"That is really a great comfort to my stupidity," said Harry, "for I never heard one of that sort before."

"Now, my dear Harry, let me go on to another, which I must tell you beforehand is of quite a different kind. It is a charade—

"My first is a French negative; my second an English characteristic; my whole, the essence of all the charades that ever were or ever will be written."

"I do believe it is *nonsense*," exclaimed Harry.

“It is, Harry,” said Lucy. “How did you find it out?”

“By my English characteristic,” said Harry, drawing himself up with a look of mock pride.

“Since you have found this out,” said Lucy, “perhaps you can find out the next, and it is the last. Now this is not a charade, it is a conundrum—Burke’s famous satirical conundrum.

“What is majesty, stripped of its externals?”

Harry went to work, carefully and rationally considering—what are the externals of a king?

But Lucy, laughing, told him that all his fine reasonings would only carry him away from the answer.

“Lead me to it, then,” said he, “the way you found it out.”

“I did not find it out,” said Lucy; “but I will tell you how I happened to know it. Once in my old copy-book, in large hand, there was the word *majesty*; it was divided this way, ma-jest-y, with hyphens between each syllable. Look, Harry, what do you see in the middle?”

“Oh! I see it now,” said Harry, “*jest*.”

“Yes,” said Lucy; “and, when I showed my copy to mamma, she, or somebody in the room, repeated this conundrum.”

“It is very good,” said Harry; “*m* and *y* are the externals, and it is *a jest*; this is very witty I acknowledge, but I never should have discovered

it. It is quite different from any of the others. The worst of it is, that, after labouring ever so hard at one riddle, it does not in the least lead to another; the next is always on some different principle."

"Yes, to be sure," said Lucy. "Nobody who knows how to puzzle would give two riddles of the same kind; that would be rather too plain."

"But then, without something to guide me," said Harry, "there is no getting on."

"Not in your regular way," said Lucy. "You cannot go on from one riddle to another, as you do in Euclid from one proposition to another, and say by the first proposition, and by the second, and so on."

"That is the very thing I complain of," said Harry.

"Complain! but, my dear Harry, riddles are meant only to divert one."

"But they do not divert me when they *only* puzzle me," said Harry.

"But the object of all riddle-makers," said Lucy, "is to make riddles as puzzling as they possibly can."

"Well, then," said Harry, "since you seem to be in the riddle-makers' secrets, Lucy, pray explain to me the ways they take to puzzle, or rather the rules by which you guess their meaning."

“ I would if I could, Harry, but I really have no rules; I can only find out riddles by lucky guesses—happy hits. I do not know how or why, but all at once I see, I feel, ‘ *that will do* ;’ a thought flashes across my mind just as quickly as the flame of that candle jumped to mamma’s taper, and lighted it as if by magic. Did you see the flame jump ?”

“ I did,” said Harry, “ and I wish the riddle-makers’ ways were as plain as that. The taper had been just blown out, and there was a little smoke, which still contained some of the inflammable gas from the melted wax; this smoke, you see, made a kind of road for the flame to run along, and in an instant the flame seemed to dart upon the taper.”

“ It is just in that manner,” said Lucy, “ that our thoughts dart from one idea to another, and sometimes without any connexion between them.”

“ No, no,” said Harry, “ we may not perceive any, but I dare say there always is some sort of connexion between our thoughts, like the train of smoke between the candles.”

“ But, mamma,” said Lucy, “ all this time I want to hear *your* riddle very much. The lady interrupted you, and you never told it. Will you give us yours now, mamma ?”

“ Mine ! my dear,” said her mother, “ it is not

mine. It was written by—but I will not tell you by whom. I never like to prejudice you by celebrated names. Judge for yourself.”

She repeated to them the following lines :—

“ We are spirits all in white,
On a field as black as night,
There we dance, and sport, and play,
Changing every changing day :
Yet with us is wisdom found,
As we move in mystic round.
Mortal, would'st thou know the grains
That Ceres heaps on Lybian plains,
Or leaves that yellow autumn strews,
Or the stars that Herschel views ;
Or find how many drops would drain
The wide-scoop'd bosom of the main,
Or measure central depths below—
Ask of us, and thou shalt know.
With fairy feet we compass round
The pyramid's capacious mound,
Or step by step ambitious climb
The cloud-capp'd mountain's height sublime.
Riches though we do not use,
'Tis ours to gain, and ours to lose.
From Araby the blest we came,
In every land our tongue's the same ;
And, if our number you require,
Go count the bright Aonian quire.
Would'st thou cast a spell to find
The track of light, the speed of wind ;
Or when the snail, with creeping pace,
Shall the swelling globe embrace ;
Mortal, ours the powerful spell—
Ask of us, for we can tell.”

“ Beautiful !” cried Lucy.

“Yes; beautiful poetry at least,” said Harry, “whatever else it is. Mother, will you repeat it once more, for I quite forgot to think of finding it out?”

After it had been repeated, Lucy had several of the lines by heart, and Harry had all the ideas. Lucy made a variety of good guesses; but, wonderful to tell! Harry found it out first. He fixed upon one positive assertion—

“From Araby the blest we came.”

Here was a clear fact; by the test of which he tried all his own suppositions, and all Lucy’s guesses, as fast as they occurred.

“In every clime our tongue’s the same,” repeated Lucy; “that may be the alphabet.”

“That did not come from Araby the blest—it came from Phenicia, you know, my father told us,” said Harry.

“Hieroglyphics, then,” said Lucy. “They are in every tongue the same. They will *do* for what is said about the pyramids too.”

“But hieroglyphics came from Egypt, not Arabia,” said Harry.

He had thought of a telescope, and a barometer, and a pedometer, one after another, as he heard, of numbering “the stars,” and of measuring the height of the “mountains,” or the breadth of the “pyramids.” But none of these things came from “Araby the blest.”

Lucy, mean time, had flown off, as she was bid, to the muses.

“If our number you require,
Go count the bright Aonian quire.”

“Their number must be nine, Harry,” said she.

“Then I know what they are,” cried Harry;
“the nine Arabic figures. We have it, mother!”

“Yes, they come from Araby the blest; and they can number the stars, and measure the earth. They do all that is required. Harry is right, is not he, mother?” cried Lucy. “I am sure he is, by your smile.”

Her mother made no answer, but repeated—

“We are spirits all in white,
On a field as black as night;
There we dance, and sport, and play,
Changing every changing day.”

“Chalk figures on a black board,” said Harry.

“Or figures on a slate,” said Lucy: “they are white on a field of black, and they change every day on my slate, I am sure.”

“Now you have it,” said their mother, “and good night. It is very late: we must roll Harry back again.”

“One moment, mamma,” said Lucy. “Before we go, will you now tell us who wrote those lines?”

“The same person who wrote the hymns which you learned by heart, Lucy. The same person, Harry, who wrote your favourite ‘Perseverance

against Fortune,' and many other things in 'Evenings at Home,' which you like so much."

"Mrs. Barbauld, mamma! The same person who wrote the beautiful essay* you read in that book we saw at Digby Castle; at the end of which was written, in Sir Rupert's own hand,

"Admirable morality, in most elegant and classical language. I wish Mrs. Barbauld had written more."

* "Against Inconsistency in our Expectations," in "Miscellaneous Pieces," by J. Aikin, M.D., and Anna Lætitia Barbauld.

CURIOUS QUESTIONS.

“PAPA,” said Lucy, “I wish you would be so good as to give Harry and me one of your old sort of puzzles.”

“My old sort of puzzles, my dear! What do you mean?”

“Such questions, I mean, as you used to ask us sometimes when we were sitting round the fire last winter. You may remember, papa, one in particular which I found out—it was Sancho Panza’s judgment, when he was governor of the island, about the old man and the ten golden crowns which were hid in the hollow staff. Can you give us some other questions like that, papa?”

“Pray do, father,” said Harry; “or, if you have none of those ready, some question like Hiero’s crown, or the kite and Pompey’s pillar.”

“Only, whatever it is, pray, papa,” added Lucy, “let there be along with the question some little story.”

“But, my dear children,” said their father, “I am not a bag of stories and questions, as you seem

to think me, into which you can put your hand, and pull one out whenever you please. You must give me a few minutes for recollection. By the time you have finished that game of chess, perhaps I shall have thought of one."

In a few minutes Lucy warned her father that she should very soon be beaten.

"There!—check-mate—it is all over with me."

"But you made no battle," said Harry; "you were not worth beating—you were in such a hurry to get to the story."

"May be so," said Lucy. "Now papa is going to begin, and we may roll your sofa up close to the tea-table." This being done, their father began as follows:—

"Three Arab brethren, of a noble family, were travelling together for improvement. It happened, one day, that their road lay across a great plain of sand, where there was little else to be seen except a few tufts of grass. Towards the close of the day they met a camel-driver, who asked them if they had seen, and could give him any tidings of, a camel that he had lost.

"'Was not your camel blind of an eye?' said the elder brother. 'Yes,' said the camel-driver. 'It had a tooth out before?' said the second brother. 'And it was lame?' said the third. 'Very true,' replied the man; 'pray tell me which way it went.' 'Did it not carry?' asked the

Arabians, ‘a vessel of oil and a vessel of honey?’ ‘It did, indeed,’ answered the camel-driver: ‘pray tell me where you met it?’ ‘Met it! We never saw your camel,’ they replied.

“The enraged camel-driver could not believe this; he charged them with having stolen his camel, and brought them before the prince. From their manners, and the wisdom of their answers to the questions which the prince asked them upon other subjects, he was persuaded that they were above committing such a theft. He set them at liberty; but requested that, before they departed, they would inform him how they could possibly have hit upon so many circumstances that were true, without ever having seen the camel.

“The brothers could not refuse to comply with so just a request; and, after thanking him for his clemency and kindness, the eldest spoke thus:—

“‘We are not magicians, nor have we ever seen the man’s camel; all we know of him was discovered by the use of our senses and our reason. I judged that he was blind of an eye, because—’

“Now Harry and Lucy explain, if you can, the methods by which the three brothers guessed that the camel was blind of an eye, and lame of a leg, that he had lost a front tooth, and was laden with a vessel of oil, and another of honey.”

Harry asked, whether there was anything in the camel-driver himself by which they judged?

No, there was nothing in or about the camel-driver that gave any assistance.

"Papa, I wish you would help us a very little," said Lucy.

"Do you not recollect telling me this morning that you knew my horse had been at the door, though you did not see it?"

"By the tracks—oh! yes, papa," cried Lucy. "No other horse ever comes up that gravel-path; and, as the Arabians were travelling on a sandy desert, probably they had seen no other tracks but of that one camel. But how did they know that he was lame of one leg?"

"The camel would put the lame foot down more cautiously than the others," said Harry, "and the trace of that footstep would be always less deep than those of the other three."

The blind eye was a more difficult question. Lucy thought the camel might have swerved more to one side than to the other; or perhaps the footsteps might show places where he had started out of the path, and always on the same side. A few other guesses were made, but nothing more was found out this evening.

The next morning Lucy said she had thought of the camel and the three brothers the moment she wakened; but the more she thought, the more she was puzzled. She was just going to add, "Papa, I give it up," but Harry advised her to

have patience a little longer. It happened, at this instant, that her mother was helping her to some honey; a drop fell on the table-cloth, and a bee, which was flying about the room, settled upon the sweet spot.

Lucy started with delight on observing this, and exclaimed, "Harry, Harry, I have found it out: the vessel of honey leaked—the drops fell on the sand—and the brother observed the little collections of bees, or insects, which had settled on them. I am right, for papa smiles. As to the oil, some of that might have been spilled by the jolting of the lame camel. The loss of the tooth is all that now remains, so I leave that to you, Harry. You look as if you had a bright thought."

"I remember," said Harry, "my father, in the beginning of the story, told us that there were a few tufts of grass on the road: the hungry camel—for no doubt he was hungry in the desert—might have bitten these, and one of the sharp-eyed brothers might have seen, that in each bite a few blades of grass stood up higher than the rest, because of the gap left by the want of the tooth."

"Now we have it all right," said Lucy; "and we were very little helped, considering—"

"But I wish we had not been helped at all," said Harry. "I wonder whether anybody of our age ever found out these questions without any help."

His father said, that the questions had perhaps never been asked before ; certainly not in the same manner in which he had put them, because he had altered them for the present purpose. In the story from which they were taken, some of the questions would have been too difficult for Harry and Lucy. But they were now ambitious to try these, and their father was willing to comply with their wish ; warning them, however, of the improbability of success.

“In the original story,” said he, “instead of a camel it was a horse ; and one of the brothers discovered that the horse had silver shoes, and a golden bit ; and he also told the exact value or fineness of the silver of the shoes, and of the gold of the bit. How did he know all this ?”

“I cannot conceive,” said Lucy. “Yet perhaps if you give us time, papa, some accident might put us in the right road. Some lucky hit, like the falling of the honey on the table-cloth, and the bee settling on it, might lead us to invent the thing, whatever it is.”

“No, Lucy,” said her father, “no lucky hit could possibly help you to this ; you want some particular facts, without which you cannot answer the question.”

“Then cannot you be so good as to tell us those particular facts ?” said Harry.

‘No, my dear,’ answered his father, “they de-

pend on the art of *assaying* metals; that is, of ascertaining their fineness and value: so I may as well tell you at once, that the wise brothers had observed the marks which the horse's shoes had left on some stones in the path; they had also observed the marks which the golden bit had left on the stone trough, at a well, where the horse had rubbed it in drinking. The skilful eye of one of the brothers had been able to judge of the fineness and value of the golden bit and silver shoes by the different colours of these marks."

Harry pondered for a few moments, and then observed, that the difficulty of explaining these puzzling questions sometimes arises from our not having the particular sort of knowledge that is necessary, and sometimes from our not being able to recollect that which we really have: "for instance," said he, "we knew all that was necessary for answering the first four questions: all the difficulty was just to recollect, and apply our knowledge to the purpose."

"You can hardly call it *knowledge*," said Lucy, "if you mean such little observations as those about the tracks of a horse, or the bees settling on the honey—everybody knows that bees eat honey."

"And yet it was for want of our recollecting those little things which everybody knows, that we were puzzled so long," said Harry.

"Well then, Harry," said Lucy, "if a fairy

were to give you your choice this minute—all the knowledge from all the books in the world, without giving you the power of recollecting it—or the power of recollecting well whatever knowledge you could acquire for yourself, which would you choose?”

“To be sure I would choose the power of recollecting well whatever I could get for myself,” said Harry; “for of what use would it be to me to have all the knowledge in all the books that ever were written, if your fairy forbids my ever recollecting any of it when I want it?”

“But I did not say that there should be any forbidding in the case: you may recollect the knowledge she gives you just as you please, or can.”

“*Please, or can,*” repeated Harry; “there is a great difference between them. To be sure, I should please to recollect, if I could, but often I cannot; and it would be still more difficult if I were to have that immensity of knowledge which your fairy offers me. I should never be able to find any one thing I wanted in such a mass: I should be my whole life getting it into any tolerable order.”

“Ah! then you would feel the use of what you would not allow when I was sorting my shells—classification, Harry.”

“No single head could contain all the knowledge of all men’s heads put together,” said Harry, “whether classified or not.”

“But suppose my fairy has the power to make yours contain it all,” said Lucy, “would you have it? Yes or no, she is waiting for an answer.”

“No, is my answer,” said Harry. “No, thank you, Mrs. Fairy, I would rather not have that load of learning; but, for the power of recollecting quickly, I should be very much obliged to you indeed. I feel every day how much I want it, and I cannot get it for myself; but knowledge I can work for, and get for myself. Nature, or one of your good fairies, must give memory. I wish one would appear this minute, and offer it to me.”

“And I,” said Lucy, “would be equally obliged to her for knowledge. But, mamma, is it not curious that Harry would refuse the offer of the knowledge, and I should be for accepting it? What would you do, mamma, and what would you, papa?”

Her mother agreed with Lucy, that she would accept the knowledge, and run her chance for recollecting what she might want. Her father joined with Harry in dreading the overwhelming quantity of learning, and in preferring the gift of recollection. It should be observed, that his father, like Harry, had not a remarkably good memory, but that both Lucy and her mother had quick recollective powers: each chose according to their sense of their own deficiencies, and each argued according to their own view of the matter.

Long, but not loud, the question was debated on each side, even till the last cup of tea lingered, and grew cold.

For some time Harry and his father maintained their argument, on the ground that it was best to accept from the fairy that which cannot be obtained by one's own exertions. But this stronghold was shaken by the attacks of the opposite party; and Lucy, or rather her mother, doubted the truth of the principle, that the powers of memory cannot be improved. At length they rose from the breakfast table pretty much, but not quite, of the same opinions with which they began. It was, however, settled that no hasty answer should be given to the fairy till the matter had been reconsidered, and that in the mean time the business of the day must proceed.

After Harry's business of the day was done, his pleasure was to make a model of a machine, which he had been inventing, with some cards that Lucy had brought him. She sat at work beside him, but her work was often put down while they talked.

"There was something mentioned yesterday evening," said Lucy, "about a kite and Pompey's pillar. I do not know what you meant about the kite, but I do know a story about an obelisk."

"I will tell you all I know," said Harry, "about the pillar and the kite, and then you can tell me your story."

“Some English sailors laid a wager, that they would drink a bowl of punch on the summit of Pompey’s pillar: now, that pillar is almost a hundred feet high, and it is quite smooth, so that there was no way of climbing to the top, even for sailors, who are such experienced climbers. The question my father asked me was, how did they get up?”

“I cannot conceive how a kite could help them,” said Lucy.

“You shall see,” said Harry. “They flew their kite exactly over the pillar, so that when it came down on the opposite side the string lay across the top of the capital. By means of the string, they pulled a small rope over, and by this a larger one, that was able to bear the weight of a man: a pulley was then fastened to the end of the large rope, and drawn close up to the upper edge of the capital; and then, you know, Lucy, they could easily hoist each other up. They did more, for they hoisted the English flag on the top of Mr. Pompey’s pillar, and they drank their bowl of punch there, and they won their wager.”

“And they deserved it for their ingenuity,” said Lucy. “But my story is quite different:—One evening, after a wet day, as we were standing at the window, I observed that the ropes were very tight between the posts in the fence—they did not hang down nearly so low as

usual. Papa asked me if I could tell the reason; and I said, that I supposed the wet had swelled the ropes, and shortened them: it was about our hygrometer time, Harry, so it was easy for me to think of this. Then papa recollected the obelisk story. But first I should warn you, as he did me, that probably it is not true."

"Well, well, let me hear it," said Harry, "whether it be true or false."

"Then you must know, that there is at Rome a famous obelisk of Egyptian granite, and of prodigious weight. After it had been brought from Egypt to Rome, it lay on the ground a length of time, no one having ventured to erect it: at last a great architect and mechanic was employed for this purpose by the Pope. Great preparations were made, for fear of injuring the obelisk, if it should fall; but my father did not describe the machinery."

"I am sorry for it," said Harry.

"I could not have remembered it for you if he had. Whatever the machinery might have been, the obelisk was at last raised, so as to be very nearly, but not quite, upright. The men pulled and pulled at the ropes—but oh! terrible disappointment, it was found that they could not be tightened any more, by any means that had been provided, or that the architect could suggest. There the obelisk hung—the workmen at a stand—the spectators all silent, and the architect in

despair! I forgot to tell you, Harry, that the Pope had ordered, under pain of death, that nobody should speak during the operation: but at the instant, when none knew what to do, a Leghorn sailor from the crowd called out with a loud voice, ‘*Wet the ropes.*’ Water was thrown over them; they soon shortened just sufficiently to raise the obelisk to its right place, and it stood perfectly perpendicular. And the sailor, instead of being punished for disobeying the Pope and speaking, was rewarded with a patent, which gave him the privilege of supplying the palm-branches used on Palm Sundays.”

Harry thought it was a pretty story, whether true or not; he could scarcely think, he said, that the shrinking of the ropes would have been sufficient, nor could he imagine how the people could get up to wet them all. It however reminded him of a circumstance which he had heard his father relate to Sir Rupert Digby.

“The walls of some great building in Paris were beginning to give way under the weight of the roof. They were pressed outwards, and were no longer exactly perpendicular. To squeeze them in, and make them again upright, was the thing to be done: for this purpose several strong iron bars were laid across the building from wall to wall, about half way up, and their ends were left projecting on the outside: fires were then

lighted underneath these iron bars, till they were nearly red hot, which caused them to expand; and, while in their highest state of expansion, large thick plates of iron, with holes in their centres, were slipped on the ends of the bars, close up against the outside of the walls, and secured there as firmly as possible by great iron nuts, which screwed on after them. The bars were then allowed to cool, and in cooling they contracted, and consequently the iron plates and the walls with them were drawn a little closer together. The operation was then repeated with another set of bars, and so on alternately with the two sets, till the walls were gradually restored to their perpendicularity."

Lucy thought this exceedingly ingenious. She observed, too, that Harry had recollected it at the right moment, though he complained so much of his want of memory.

After this a long silence ensued.

"What can you have been thinking of all this time?" said Lucy. "Only of that model you are making?"

"I have been thinking of a great many other things," said Harry. "Among others, of some of the questions my father asked us last winter. Do you remember one about a Persian painter? I cannot recollect exactly how it was."

"Yes, I remember it," said Lucy. "It was a

very simple thing, and yet I could not answer it. An Indian prince, a conqueror, Kouli Khan, or Nadir Shah, or Tamerlane, or Bajazet, or some of those people, found among his prisoners, after some great victory, a Persian painter. Now the conquering prince, whoever he was, was not remarkably handsome; he was blind of an eye, lame of a leg, and one of his arms was shorter than the other: but this man pleased the prince so much, by drawing his portrait in an attitude which concealed all his personal defects, that he gave him his liberty without ransom, and of course half a dozen purses of gold besides. He painted the prince drawing a bow, kneeling on the lame knee, shutting the blind eye, and pulling back the lame arm. This attitude was the question."

"Well done of the painter!" said Harry; "but not well done of Lucy, for this I think was an easy question, particularly for you, who draw, and are used to think of attitudes for figures. How happened it that you could not find it out at the time you wanted?"

"Because I was thinking of something else."

"What! when papa asked you the question?"

"Yes," said Lucy; "it put me in mind of something else at first setting out, and off went my head to that other thing, and I could not get it back again."

"And pray what did it go off to?" said Harry.

“Oh ! to nonsense, my dear,” said Lucy. “First, when my father spoke of an Indian prince and a great conqueror, I began to think who it could be that was lame and blind, and such a frightful figure. Then I thought of Tamerlane, and then of the iron cage in which he shut up Bajazet ; and then off went my thoughts still further to a print of Garrick, in the character of Bajazet ; then came his great turban before my eyes, and the little cock’s feather in front, which I thought looked like the feather of spun glass, that you gave me ages ago ; this put me in mind of mamma’s saying it was dangerous to wear that spun glass, because the little bits might fall into our eyes. My thoughts then jumped off to the glass-house. In short, when papa asked me for the answer, I started—my head was a hundred miles off at least.”

“I have often done the same thing, and felt the same way,” said Harry, “about questions my father has asked us. Another reason for my not finding out the right answer is, that some fixed notion has taken possession of my wise head beforehand, and of which I cannot get rid. Did you ever feel this, Lucy ?”

“Oh yes,” said Lucy ; “and I recollect having often been a provokingly long time in answering something that was quite easy, merely because I had made sure that it was difficult. For instance, that easiest of questions, which you asked me once

—a herring and a half for three halfpence, how many for eleven-pence?—I fancied, because it was so gravely asked, there must be something difficult in it.”

Harry smiled.

“And you, Harry, yourself,” continued Lucy, “may recollect you were full as long a time as I was about the herrings, in finding how to write fifty-six with four fives?”

“Yes,” said Harry, “because I had taken it into my head that it must be written in Roman figures, and this prejudice prevented me from thinking of the right way with common figures and fractions, in this manner, $55 \frac{5}{5}$. But now,” continued Harry, “let me, before I forget it, give you another, a better or a worse, instance of the same sort of prejudice, in a real good question of my father’s. Some time ago, the day my father took me into the dock-yard, he showed me a ship lying in what is called a dry dock. The keel was to be repaired, and for this purpose it was necessary to raise up the ship, so that the workmen might get underneath. The question my father asked me was, ‘how the vessel could be raised?’ I was an hour puzzling about it, because I was prepossessed with a particular notion about tackles and ropes, with which I had seen sailors raising and lowering a boat, and I thought the ship could be raised only in that sort of way. My father showed me the

absurdity of that idea, and then I thought of levers, but I could get no further. I went on thinking of levers, and pulleys, and windlasses, but never of the easy way that was before my eyes—to let in the water from the outside of the dock. The water, you know, would gradually float the vessel, and raise it up to the proper height, where it could be propped up, and the water let out again next tide.”

“How simple!” said Lucy. “Just as our boat in the lock was raised. I wonder you did not think of that. But, Harry, yesterday I heard my father talking to you of some different way of raising a ship when it wanted to be repaired. I came into the room in the middle of what you were saying. I wish you would explain it, if you can.”

“I will try,” said Harry. “You must first of all know, that, when a vessel is floated into a dock to be repaired, *she* is allowed to settle down with her keel upon thick wooden blocks, along the middle of the dock: and then I must tell you, Lucy, that formerly when she was to be raised up, for the people to get under the keel, two or three hundred *shores*, or props of timber, were placed all under her bottom, nearly upright; wedges were then just pointed under the lower end of each of these shores, and all the workmen from every part of the dock-yard being summoned with their *malls*, or huge hammers, and stationed one or two to each

shore, the wedges were all struck at the same instant by word of command. A few blows from all the malls were sufficient just to raise the ship from off the blocks, which were then taken away, and the ship was left hanging in the air, supported by the shores.

“ This was a very troublesome business, and wasted a great deal of time and labour ; but by the new way all this difficulty is avoided. The blocks on which the keel is to lie are not solid lumps of wood ; they are composed of three parts, two of which are wedge-shaped, and are laid the narrow end of one under the thick end of the other, so that the third part, a solid block, may lie level and evenly upon them. The ship is floated into the dock as usual, and, when the water subsides, the keel rests on the new-fashioned blocks : the forest of shores are then firmly placed under all parts of the ship’s bottom, in the same way as I described to you before, but without any wedges. Now, Lucy, comes the beautiful contrivance—two or three men only are sufficient to do the rest : they give a few knocks on the sides of the wedges of which the blocks are composed—out they fly—the blocks sink, and the ship hangs on the shores. I do hope you understand this, Lucy.”

“ Yes, I am sure I do,” said Lucy ; “ but it is such a pretty contrivance, that I should like very

much to see it done. Suppose you make an experiment with your little boat in our canal."

"So I will with pleasure, when I am well," said Harry. "It is very agreeable to explain these things to you now, Lucy," added he, "because you do not think you know it all before I can get my words or thoughts out."

"It is a great while, Harry," said Lucy, "since you called me Mrs. Quick-quick."

"It is a great while," said Harry, looking a little ashamed, "and I am glad of it. I think you are quite cured of that, Lucy," added he.

"Are you sure that I am quite cured?"

"Yes, perfectly cured," he twice repeated, with emphasis; "and, even if you had not cured yourself, I should not be so impatient now, I hope, as I was then; I should be very ungrateful if I were. You, who are so kind and good-natured to me! thinking of nothing from morning to night but what you can do to make me happy."

"Then, if you are happy, so am I," said Lucy. "But, Harry, I must tell you that you are a little mistaken—I am often in too great a hurry still; though you do not see it, because I have learned not to be in such haste to speak; but in thinking I still often make sad mistakes, and really am prevented from finding things out by being too quick."

“ Give me an instance,” said Harry.

“ I will,” said Lucy, “ about a thing that happened very lately. When we were walking in the garden, papa and I stopped to look at the sundial, which put him in mind of a story. He told me that there was a statue, I forget where: on the statue was this inscription,—‘ Whoever watches my head, and opens it on a certain day of the year, and at a certain hour of that day, will, if the sun shines, find a treasure.’ The day and hour were mentioned. On the appointed day, and at the appointed hour, some travellers, who had read the inscription, assembled round the statue. The sun did shine: but what was to be done? Some were for pulling the statue down to get at its head, for it was of gigantic height—others proposed clambering up, to break open the head. They did scramble up, and they did open the head, but there was nothing in it. The people were very much disappointed, and they all went away, one after another, grumbling at the statue and the inscription, which had made such fools of them. One, however, wiser than the rest, stayed behind, and, understanding the inscription rightly, followed its directions, and found the treasure;—and how did he find it? was the question papa asked me, and now I ask it you, Harry.”

Harry said he had met with the story somewhere before. The man observed where the shadow

of the statue's head fell on the plain at the appointed hour, and there he opened the ground, just under the shadow of the head, and found the promised treasure. Was not that the answer?"

"Exactly," said Lucy; "but I could not find it out, and all because I was too quick."

"How did your quickness hinder you?" said Harry.

"I recollected another statue of which you had told me, Harry; and as soon as I heard the words *statue*, and a *certain hour*, and the *sun shining*, I galloped off to your statue of Memnon, which, at a certain hour in the day, when the sun shone on it, used to send forth certain musical sounds; for the music was made, as you told me, by the air, when heated, rushing out of holes in some pipes, which were in Memnon's lyre. Of all this I was thinking, and contriving how I could make sense of it, for I imagined that the statue's head must be managed in the same way. Then another strange thought came into my head, that the music, which I had settled this statue should play, should be like our play of *magical music*, and that it should sound loudly or softly, as the travellers went nearer or further from the right place, and so guide them to it."

"Very ingenious at least," said Harry.

"But it was all wrong," said Lucy. "But I see mamma before the door with her bonnet on."

cried Lucy, "starting up and looking out of the window. "I dare say she is going to walk to Digby Castle, and I should like to go with her, if you can spare me, Harry."

"Oh! yes, and thank you for the time you have stayed," said Harry. "Only, before you go, give me a few large pins—six stout pins. Thank you! Now away with you, my dear. I shall be quite happy till you come back again."

MIRROR.

WHEN Lucy returned from her walk, she brought a basket, filled with flowers, from the hot-house at Digby Castle. After holding them for half a minute to Harry to admire and smell, she began to put them into a flower-pot, telling him that she had something solid for him at the bottom of her basket, under the flowers.

“I know what it is,” said Harry; “it is a book.”

Lucy looked immediately at the sides of her basket, to see if Harry could have spied the book through the openings of the wicker-work, but that was impossible. “You only guessed, I suppose, Harry, that it was most likely I should bring you a book.”

Harry said that he did not guess, but that he was quite sure of it. On which Lucy went to his sofa, and looked from thence out of the window.

“But you could not, while lying here,” said she, “see the mountain path down which we came.”

“I did see you,” said Harry, “walking down that path with a book in your hand, and, when you reached the great thorn-bush, I saw mamma sit down.”

"Then, Harry, you must have got off your sofa to look out of the window," cried Lucy. "Oh fie! Harry, you were not to quit your sofa without leave from the surgeon."

"I never stirred from the sofa," said Harry.

"Oh, I have it now," cried Lucy—"the mirror out of the camera obscura."

"You are right," said Harry. "Now tell me what is the book you were looking into, and where is it?"

"It is here in my basket," said Lucy, "but you shall not know its name yet. I must first tell you, that in our walk to Digby Castle I was giving mamma an account of what you and I had just been talking about. She said nothing, or very little—only smiled now and then. When we reached the castle, she went to the library to look for some books; and among others she took down this, which she put into my hand, telling me that perhaps I should find some things in it like what you and I had been saying to each other. The author was a most celebrated philosopher. I will not tell you his name, Harry; but only think of his having observed in his own mind the very same sort of faults that we find in ours. Look at the heads of these pages—'*Wandering Attention.*' That is my complaint. Then comes—'*Words—abuse of;*' that means something like what you hate in riddles, Harry; play upon words, or using

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words inaccurately, which, he says, is a very great fault in reasoning."

"I like him for that," said Harry, "whoever he is."

"Then," said Lucy, "here comes '*Prejudice*,' and here is '*Transferring of Thoughts*;' by which he means *not* transferring, the not being able to turn them from one subject to another easily. That, you know, Harry, is what you call your great *hindrance*. Look, here it is."

"My picture at full length," said Harry. "Let me look at it."

"But it is not like you *now*," said Lucy, holding the book fast.

"Let me see," said Harry; "or, if you will not let me see, let me hear."

Lucy read aloud—

"Men thus possessed in company"—

"That is, with their own favourite thoughts," said Lucy.

—"are as if they lay under the power of enchantment. They see not what passes before their eyes—hear not the audible discourse of the company."

"Like me, I acknowledge, on my disagreeable day in the carriage," said Harry, "when I did not hear what any of you were saying."

"Oh! listen to this," continued Lucy.

"And when by any strong application these absent people are roused a little, they are like men brought to themselves from some remote region; whereas, in truth, they come no farther

than from their secret cabinet within, where they have been wholly taken up with the puppet which was for that time appointed for their entertainment. The shame that such *dumps* cause to well-bred people, when it carries them away from the company where they should bear a part in the conversation, is a sufficient proof that it is a fault in the conduct of their understanding."

Lucy repeated her opinion that this was not like Harry *now*, with a very strong consolatory emphasis on that word.

"But tell me," said Harry, "what were you and my mother doing when I saw you at the thorn-bush? you and she opened and shut the book several times. What were you about?"

"Looking at different parts of this book," Lucy replied. "Mamma informed me, that it will tell us not our fortunes but our faults, therefore whoever does not like to know them must not open it."

"I am not such a coward," said Harry, "nor such a fool. I will open it directly."

"Then I must hold it for you," said Lucy, "as mamma did for me."

She held it between her hands, and bade him put his finger into the leaves, and take his chance.

Harry opened, and read at the head of the page, "Presumption."

"That is no fault of yours, luckily for you," said Lucy. "Let me try. Will you shut, and I will open?"

She opened at "Despondency."

"No fault of mine," said Lucy. "This is not

a good hit either. But I must tell you, Harry, how luckily the book opened once for me when mamma held it. It opened at '*Similes*.' Pray read what is said about those who are always finding similes. Begin here :

"An aptness to jumble things together wherein any likeness can be found, is a fault in the understanding. Near akin to this is letting the mind, upon the suggestion of any new motion, run immediately after similes to make it the clearer to itself."

"Then," interrupted Lucy, "he goes on to prove that this is wrong; and he says that these simile-lovers are apt to mistake what is prettily said for sound knowledge, because they are content with their similes, which are never exact. That is what long ago, Harry, you used to complain of in my similes. Do you remember?"

"I should like to read that book," said Harry.

"No, my dear Harry, I don't think you would; it is in such old-fashioned tedious language, it would tire you with its *whereas's* and *wherefores*, and parentheses, and round-about sentences. One thing, however, will please you," said Lucy, "a grandissimo panegyric that mamma showed me on mathematics*; and in the same page

* "I have mentioned mathematics as a way to settle in the mind a habit of reasoning closely and in train; not that I think it necessary that all men should be mathematicians, but that having got the way of reasoning, which that study necessarily brings the mind to, they might be able to transfer it to other parts of knowledge."

he says something about the way in which young scholars think and feel when first they begin mathematics. You can say whether he is right or wrong there."

She read the passage* to him, and he said that all about the young scholar was true, as far as he could judge. "Now, Lucy, tell me the name of the book and the author."

"*'Locke on the Conduct of the Understanding'*—the great Locke!" said Lucy. "Now, Harry, is not it curious that we should have thought and said to each other some of the same things which this grand philosopher says in this book? But, Harry, it does not seem to surprise you. Do not you think it extraordinary?"

"N—o," said Harry. "It would have been surprising, indeed, if we had thought the same as the great Locke about anything else. But who could know so well as ourselves what passes in our own minds? and there must be some likeness between all people's minds. Pray, does this book tell us how to *cure* these faults?"

"Mamma says," replied Lucy, "that, when I

* "He that has to do with young scholars, especially in mathematics, may perceive how their minds open by degrees, and how it is exercise alone that opens them. Sometimes they will stick a long time at a part of a demonstration, not for want of will and application, but really for want of perceiving the connexion of two ideas, that to men whose understanding is more exercised is as visible as anything can be."

am old enough to study it attentively, I shall find a great deal of excellent advice in it; but I have only read the one page about my old disease of wandering thoughts."

"Will you leave it on the sofa?" said Harry; "if it tires me, I need not read it."

"But, Harry," said Lucy, "before I go, I wish you would tell me why you were so anxious about those riddles and puzzles? why you made me recollect for you, step by step, how I found some out, and how I failed in others?"

"Because I thought it might teach me to invent," said Harry.

"My dear Harry! to invent riddles and puzzles, do you mean?"

"No, I do not care about them," said Harry; "but I thought that, if I discovered what it was that puzzled me in the riddles, I could by the rule of contraries, prevent myself from being puzzled in other things."

"Well, could you make out any general rules?" said Lucy.

"Yes, I think I have made out one," said Harry. "You know that we found out the 'figures on a slate' by sticking to 'Araby the blest'; therefore in all cases we should guide ourselves by some one thing which is certain, and thus go on from the known to the unknown."

"Yes, and *kill off* the wrong guesses that do

not agree with that one fact," said Lucy. "Like the play of the four-and-twenty questions, where you find out what a person is thinking of by asking, Is it animal? or vegetable? or mineral? and so on; and each answer telling what it is not, brings you nearer to what it is, till at last you come quite to the right thing. So far so good for riddles, and more good than I expected; and as for the story-questions, it appears that the difficulty is less often in the question than in ourselves, in our own minds."

EXPERIMENTS.

ONE fine sunshiny day, Lucy, coming in after a long walk, opened the door of the drawing-room, where Harry was now daily stationed on his rolling sofa, and perceived that all the window-shutters were shut.

“My dear Harry, what is the matter?” cried she.

“Nothing is the matter; but take care, take care!” cried Harry, “do not knock down my little table.”

“I cannot see your little table,” said Lucy; “let me open a bit of this shutter.”

“Not for your life!” cried Harry, “my father has just fixed it all for me. Only walk straight to my sofa, and shut the door after you; my father is going to show me some of Sir Isaac Newton’s famous experiments on light and colours: and, my dear Lucy, your setting me in pursuit of the green and blue shadows is the cause of all this happiness to me. My father came in, and found me at that book. He talked to me about it, and found out what I did understand, and what I did

not, and then he said that all my pains should not be wasted. He will give us half-an-hour a day as long as I am confined to the sofa, to show us these experiments, and perhaps he will tell us something about the cause of those colours in soap bubbles, about which we have been so curious.”*

Lucy now found that she had been mistaken in supposing that Harry could not pursue any entertaining experiments while out of the reach of laboratory and workshop; and her father assured her, that many most ingenious experiments have been tried by the greatest philosophers with the simplest apparatus. He recollected having seen a letter from Sir Humphry Davy, agreeing with Priestley in opinion, that no man who waits to try experiments till he has every convenience prepared will ever make any discoveries in chemistry.

“But I hope,” said Lucy, “that our friend Sir Rupert Digby’s having such a nice laboratory and workshop does not prevent him from being a philosopher.”

“Not at all,” said her father; “that does not follow. What I tell you may be a comfort to those who have not these advantages, and may prevent them from conceiving that they are essential to success. A great deal may be done without them, but a man of fortune cannot employ his

* No account is given of these experiments, because they can be found in “Scientific Dialogues,” and various other publications.

wealth better than by preparing such conveniences for learning and science. I would say here the reverse of what a great moralist has said upon another occasion : Dr. Johnson observes, that it is often misery to want what it is not happiness to possess. I should say of the workshop and the laboratory, It is often happiness to have what it is not misery to want."

In repeating these experiments of Sir Isaac Newton's, his father told Harry that he had a further object than his mere acquisition of the facts ; he wished his son early in life to observe with what care and exactness this great philosopher had conducted his experiments ; how cautious he was to make himself certain, by repeated trials, of the causes of the effects produced ; never venturing assertions, nor trusting to his own suppositions, till they had been verified by repeated trials ; never hazarding general conclusions from a few facts, and, what is perhaps the most difficult of all, never taking anything for granted.

Lucy having expressed some surprise at her father's saying that this was the most difficult, he smiled, and said, " Perhaps the day will not pass without your giving me some little opportunity of proving it to you by your own practice."

A little while afterwards, Lucy, who was making some pasteboard model for Harry, went into a closet, opening into the drawing-room, to look for

a saucer-full of paste which she had left there; but the mice had eaten it, and she was forced to wait while a fresh supply was preparing. During this interval many were her invectives against the whole race of mice, and many her resolves to put the saucer this night where none could reach it. She stood with an old newspaper ready spread on the table for pasting; suddenly a paragraph in it caught her eye, and she exclaimed, "Now, mice, I defy you, and all your nibblings. Mamma, look here, I have found an *infallible* receipt for preserving paste, or anything, 'against the depredations of mice.' The easiest way in the world, mamma—only to surround it with sprigs of mint. Pray, mamma, read this."

"I read it three months ago, my dear," said her mother, "and I tried it. I surrounded a plate of paste with sprigs of mint, and next morning I found much of the paste gone, and the mint scattered. I repeated the experiment with different things, and always with equal want of success."

"There is an end then," said Lucy, "of the *infallible* preservative."

"I do not know much about plants," said Harry, "but I believe there are different sorts of mint; they may not all have the same properties. Perhaps the mint you used, mother, might not be the kind recommended in the receipt."

His father observed, that Harry's was a good

suggestion ; that every circumstance should be the same in repeating an experiment, otherwise it is not fairly tried, and the conclusion cannot be depended upon.

Lucy expressed a wish to try the experiment for herself, if her mamma would not be offended ; but Harry assured her that nobody ever thinks of being offended about trying experiments.

“ Then I will run out to the garden, and gather plenty of mint,” said Lucy.

Away she ran ; and at night she fenced her paste-plate round with a double row of different kinds of mint : thus entrenched, she placed it on the same shelf, in the same closet, and shut the door. In the morning her father and mother were at the opening of the closet. To her agreeable surprise she found that the paste had not been touched ; there were no marks in it of little feet or nibbling teeth, and the sprigs of mint remained exactly in the same order in which she had arranged them.

“ Well ! mamma, what do you think now ?” said Lucy. “ Perhaps the receipt writer may not be mistaken after all. Perhaps, mamma, you did not join your fence of mint as well as I did ; perhaps you had not a double row, or you left some little loop-hole for the mouse to push his little nose into. What do you think, mamma and papa ? and what do you think, Harry ?”

The door of the closet being open, he could see all that passed.

“Why do not you answer, Harry? What are you looking at?”

“I am looking at something which you had better see before you decide,” said Harry.

Lucy followed the direction of his eyes, and saw, just peeping out over the top of a basket, which stood in the corner of the closet, the head of a cat

“Oh, pussy! are you there all this time?” cried Lucy.

At this instant the cat jumped out of the basket, and stretched herself as she awakened. Upon inquiry, it was found that a servant, who had heard Lucy complain of the loss of her paste, and who had not known of the mint experiment, had put the cat into the closet.

“Then I suppose,” said Lucy, “that it was the cat frightened away the mice—I give up the mint.”

“No,” said Harry, “do not leave it to *suppose*; do not give it up till you have fairly tried the experiment. To-night make sure of the cat, and leave the mint as before.”

This was done; and the result was, that the mint was found scattered, and the paste eaten.

“Now I *am* convinced,” said Lucy. “But how very extraordinary it is, papa, that the mint should

have succeeded for the man in the newspaper, and not for us."

"Perhaps he never tried the experiment," said her father.

"Oh, papa!" cried Lucy, "do you think anybody would publish that mint is an infallible preservative against mice, without having tried it? When I saw those words in print, papa, how could I help believing them?"

Her father laughed, and told her that she must not believe everything she saw in print. "A friend of mine," said he, "once found a young man reading a romance called *Amadis de Gaul*, which is full of impossible adventures: when he asked the young man whether he believed that it was all true, he answered, 'To be sure, sir; it is in print.'"

"But, father," said Harry, "I think, unless Lucy had been very disagreeably suspicious, she could not have acted differently. How could she possibly tell that the man in the newspaper was not to be believed, or that his experiments were inaccurate? She has been used to live with people who tell truth, and who are accurate."

"For that very reason, my dear Harry, I, who have had experience of a contrary kind, should put her on her guard against that which at her age she could not possibly imagine, without being, as you justly say, disagreeably suspicious."

Harry felt that this was just; but still he looked

as if he had something else sticking in his mind and which his understanding could not swallow.

“What is it, Harry?”

“It is this, father,” said Harry; “if we were to try all experiments over again before we believed them, we could never get on. Something must be believed—some things that are printed must be *taken for granted*.”

“True, Harry,” said his father. “The question therefore is, *what* we should believe, and *whom* we should trust—you want rules to guide you. Is this what you mean?”

“Exactly,” said Harry.

Here Lucy was tired, and went away to make his pasteboard model, leaving Harry to go down to the bottom of the well in search of truth.

“Well, Harry,” said his father, “take, for instance, Sir Isaac Newton’s experiments; before we tried them over again, you believed in them, did not you?”

“To be sure I did, father.”

“And why, Harry?”

“Because I knew,” said Harry, “that he had the character of being accurate, and that many other people had repeated them.”

“Good and sufficient reasons they are, Harry. But, when you do not know the character of the person who makes an extraordinary assertion then how would you judge?”

After a few minutes' reflection, Harry said, "By considering whether the fact be probable or improbable."

"Right," said his father; "when anything appears contrary to our experience, then it is necessary to examine the circumstances carefully, but, at the same time, candidly. Some things in science, that appeared incredible at first sight, have been found perfectly true. Remember the astonishment produced by the electrical shock, the powers of steam and gas, air-balloons, and steam-boats. Suppose you heard of these things for the first time, you would probably have thought the accounts ridiculous. Did you hear what your mother was reading last night, from that new book of Travels in Mexico?"

"Oh, yes," said Harry; "you allude to the Mexican, who was told by a man from Europe that by means of a boiling tea-kettle a thousand persons could be safely moved a hundred miles a day. This was only exaggeration. But there was also an absurd story, which the poor Mexicans were told, that at Birmingham the clergymen are made of cast-iron, and that they preach by steam. Now, if I had been a Mexican, I never could have believed that, if fifty thousand people had told it to me, because iron cannot feel, or speak, or think.

Lucy returned to consult Harry about the

pasteboard model. She waited respectfully while her father finished what he was saying. She heard these words:—

“Then you feel, Harry, that no assertions could make you believe impossibilities; and, that in all cases which are contrary to our experience, it is necessary to pause, and doubt, and examine. I may add, that you will sometimes find it necessary to doubt even the evidence of your own senses.”

“Oh, papa!” exclaimed Lucy, “the story you told us of the celebrated instrument-maker and his wig, is a good example of that.”

“What can you mean, my dear?” said her mother.

“Your mother was not present when I told Harry and you that anecdote,” said her father; “explain what you mean.”

“Then, mamma, I will tell you. There was a famous mathematical instrument maker—”

“Not there *was*, but there *is*,” interrupted her father. “Happily he is now living, and will, I hope, long live to be of service to science, and an honour to his country.”

“An Englishman, mamma,” continued Lucy, “and a very, *very* famous instrument maker—”

“Say Troughton—that’s enough,” whispered Harry.

“Well, then, Troughton,” said Lucy, “having

finished some great instrument, of which a magnetic needle formed a part, went to examine it for the last time, and found, to his great surprise, that the needle pointed to different divisions at different times. Having made this needle with great care, he could not believe that it did not do its duty; he thought there must be some key or knife about him which attracted it—but no, there was nothing of the kind in his pockets. He reasoned and reasoned, but in vain, he could not discover the cause; he tried again and again, the same effect always took place; and what made it still more wonderful, was, that when other people looked the needle was quite steady. This perplexing instrument was the first thing he thought of when he wakened next morning, and he hurried out of bed in his night-cap to look at it. He found it quite steady: yet after breakfast, when he looked again, it was again all wrong. But now, mamma, he had a distinct fact to guide him; when wrong, he had had his wig on—when right, his night-cap. Upon a little reflection, he recollected that his wig was fitted with small *steel* springs, to make it sit close to his head. The wig was thrown aside, and the instrument was perfect.”

EXPERIMENTS.

“MAMMA,” said Lucy, “I think it was scarcely worth while to spend so much time and so much talking upon those little cat, and mint, and paste experiments.”

“My dear,” said her mother, “if it be worth while to try an experiment at all, it is worth while to try it accurately. Half-tried experiments are waste of time indeed, they leave us no wiser than we were before; or, what is worse, they lead us to reason upon wrong grounds, and we become only the more ignorant and the more positive.”

“You, know, mamma,” said Lucy, “I was willing to give up before I was quite convinced.”

“Yes; but there is a great difference between being willing to give up, and being convinced. Do you not feel that it is more agreeable, Lucy, more satisfactory, to be convinced?”

“I do, mamma; if one gives up, there is always a sort of feeling that one might have been right if we had gone quite to the bottom, as Harry says;

and, after all, it is a very uncomfortable feeling not to be certain whether we are right or wrong."

"And I should be sorry, my dear Lucy," continued her mother, "that you were to despise what you call little experiments. Few people have the means of trying scientific ones; but many little experiments, which are both instructive and amusing, are within everybody's reach. Your ingenuity may be often more profitably employed in finding out the causes of common appearances, than in searching for those of the most extraordinary wonders in nature."

"But, mother," said Harry, "do you really think that one can gain much scientific knowledge by such accidental experiments?"

"No, Harry," said his mother, "certainly not much scientific knowledge; but it has been said by a very good and sensible man*, who made the human mind his particular study, that some exercises are worth pursuing, not so much for the knowledge actually gained by them, as for the discipline they give the mind. As there are some crops, which the farmer sows, not for the sake of the profit they afford, but for their beneficial effect on the soil."

That is a beautiful allusion, thought Lucy; and, in her mind, the beauty of the allusion added much to the effect of the reasoning.

* Berkeley.

“ Then mamma,” said she, “ I wish you would tell me some experiments to try of this common sort.”

“ What are you going to do, my dear, with that piece of new tape which you have in your hand?”

“ I am going to open it, mamma, and to cut off some strings for my frock.”

“ Well, before you begin, consider which is the best way to open it, that you may not tangle the piece, as you did the last which you took out of my work-box.”

“ The best way to open it, mamma? are there two ways?”

“ Yes,” said her mother; “ some people begin from the outside, and some from the inside.”

“ I have always taken the first end I found,” said Lucy, “ which was on the outside; but now I recollect, mamma, that the other day you pulled the end out from the inside, so I suppose, since you did it, that must be the best way.”

“ Try, my dear; there is a little experiment for you.”

“ Oh! mamma, do you call that an experiment?” cried Lucy. “ Yet to be sure it is,” added she, “ and a useful one too, if it settles the best way of doing what we want to do very often; and, though it is a trifle, it is better to do it well than ill, and better not to waste time by the necessity of un-

tangling it afterwards, and better not to waste temper too. Now I have wound this piece upon a card, without the least difficulty, and I am convinced that beginning from the inside is best."

"There is another obvious advantage in this method," said her mother; "when you have not time to wind the whole piece upon a card, you may take out as much or as little as you please, and leave the rest unwound, because the outer coils protect and keep in the rest."

"I shall follow the same plan with my next ball of twine," said Harry, "for that is very good reasoning."

"And there may be reasoning, I see, even about such a thing as this," said Lucy.

At that moment Lucy saw, in her mother's work-box, an amber-coloured bonbonniere of pellucid horn, starred with gold.

"Oh! mamma, I like this better than the ruby-coloured boxes. Harry, do you know how it is made? Mamma told me that the horn is softened in boiling water, and then pressed into the proper shape by a brass mould: and those pretty little stars, Harry, she says, are first placed in the mould, and squeezed in by the same operation. Mamma, may I help Harry and myself to some of these many-coloured sugar-plums?"

Leave being granted, Lucy opened the box;

but, when the top was off, she exclaimed, at the sight of certain beautiful green sugar-plums, “Do not touch them, Harry; stay one moment.”

She searched in her portfolio for a bit of an old newspaper, and said, “Now, Harry, we may try a little experiment. Listen.” She read as follows:—

“Test for detecting the poison of verdigris in sugar-plums, sweetmeats, pickles, &c.

“It is said that some confectioners give their comfits and sweetmeats a green colour by means of that dreadful poison *verdigris*. This, as everybody knows, is produced by vinegar, or any acid which corrodes brass or copper. The pickles, which are admired for their beautiful green, are often made in copper vessels; and it is even said that cooks throw halfpence into the saucepan to improve the green of French beans.

“A gentleman, whose children had been made unwell by eating these green comfits, wishes to make known the following simple mode of detecting the presence of copper:—Drop on the comfits a little liquid *ammonia*, or hartshorn; if copper be present, they speedily acquire a blue colour.”

“Now, mamma, I am not going to take it for granted that this man in the newspaper is right. This time I will try the experiment, before I say one word about believing or not believing him. If you will give me some hartshorn, mamma, Harry and I will try it this minute.”

Her mother directed her where she might find the bottle. Having brought it, and selected from the box several of the greenest of the green sugar-plums, which she put on a plate, she applied to them a few drops of hartshorn; then, adding more and more, to make herself and everybody else

quite sure of the fact, she cried, "They do not change to blue, mamma: these comfits, then, are quite safe. Hold your hand, Harry;" and, pouring a good supply into it, she added, "you may now eat them without fear."

"That I will," said Harry, as he transferred them to his mouth, "and without the least fear, because I never found that they did me any harm; and I am convinced they have no copper in them, nor poison of any kind. But, Lucy, my dear, if I had any doubt, I must confess that your experiment would not have quite satisfied me."

"Not satisfied you, Harry! Why not?"

"Because," said Harry, "you have not proved to me the truth of your *test*; you have not proved that hartshorn will turn verdigris, or anything which contains copper, to a blue colour. That was the very thing you were to prove."

"Very true, indeed!" said Lucy.

She now considered how she could try whether her test was sufficient or not.

"I must find a bit of copper—a halfpenny, mamma, will do; on it I will pour some vinegar, which will corrode the copper; and, after we have let it lie some time, if we see verdigris on the halfpenny, as I hope we shall, we will drop some hartshorn over it, and see whether it turns blue; then we shall be convinced whether hartshorn is or is not, a test for detecting copper."

Harry said this would be a very fair trial; but his mother observed, that the poison of copper was so dangerous, that she did not like to have Lucy undertake this experiment by herself; if they could wait till she was at leisure, she would assist them.

She was at leisure, or made leisure, that evening, and, without being reminded of it, recollected her promise: she put two or three halfpence into a saucer, and covered them with vinegar—at the end of a few days she took the halfpence out, and left them some time exposed to the air, when they were most satisfactorily covered with verdigris.

“Quite green! Harry, look at them,” said Lucy.

“But do not touch them,” said her mother. “A few grains of verdigris, if swallowed, might kill you. Now, Lucy, for your hartshorn—drop a little on the verdigris.”

She did so; the green colour was instantly turned to blue, and Harry was satisfied.

This evening Lucy was preparing an effervescing draught for her mother, of soda and lemon juice. The soda was in one cup, and she was squeezing the lemon juice into the other; at one unlucky squeeze the lemon juice spirted on her mother's gown her own frock, and her brother's coat—coat, frock, and gown were stained in different ways. Her mother's gown was of purple silk—that was

spotted yellow ; but her mother instantly applying soda from the cup in her hand, the yellow spots vanished, and the purple re-appeared. Lucy tried the same remedy on the coat and on the frock, but it was not equally successful—and why ?

Her father now joined in the conversation which this question produced ; and Lucy went to bed, with her mind full of experiments that it suggested.

In days of yore she had been a little dabbler in vegetable dyes ; and her mother had let her dabble on, with saffron, poppies, beet-root, and weeds innumerable. All her dabbling was not quite in vain : she had learned some curious facts, though no general principles. Now recalled to the subject, she was delighted with the discovery of a book, the next day, in the library at Digby Castle, on “ The Art of dying Wool, Silk, and Cotton.” From this she hoped to learn how to take spots out of cotton, silk, or woollen cloth ; but, though the immediate object for which she began to hunt through the book was lost in the chace, she learned a great deal that was more useful. This book told of vegetable, animal, and mineral dyes, and of those substances which chemistry has taught the dyer to use, to brighten and to render permanent his formerly fugitive colours. The beautiful system of *mordants* opened to Lucy’s view. With her understanding more enlarged than when she formerly tried the dyer’s trade, she could not be

satisfied with mere receipts—she must know the reason for what she did. Thus by degrees, with her mother's assistance and Mrs. Marcet's, the multitude of separate facts classed themselves in her mind; and from these slight experiments she gradually rose to general principles of chemistry.

“We have learned more by our little random experiments,” said Lucy one day, “than you expected, have not we?”

“Yes,” said Harry; “because, though they were little, they were not random experiments.”

Fresh subjects seemed every hour to arise, and with entertaining variety. But no more shall be told—enough is as good as a feast—in our opinion much better.

ODOMETER.

“HARRY, have you finished the model of the machine you were making with the pasteboard and the large pins?” said Lucy. “What a long time you have been about it!”

“Because I made a great many mistakes,” said he, “and was forced to alter it several times; but here it is at last.”

After a critical examination, Lucy pronounced it to be tolerably neat, considering that it was a man’s making. She thought the teeth of the wheels might have been cut rather cleaner, and with fewer jags left at the bottom of each. However, when the wheels were put in motion, the teeth took into each other well enough to show the nature of the contrivance. It was, as Harry told Lucy, an *odometer*, or a machine for measuring the length of road over which a carriage passes. This it was to perform by registering the number of turns made by the wheel of the carriage. If the circumference of a wheel is known, and the number of turns it makes are reckoned, it becomes easy to calculate the distance over which that wheel has

rolled. But this machine, fastened on the nave of the wheel, would, as Harry hoped, save the trouble of calculation; it being so contrived as to show with two hands on a dial-plate, in miles and furlongs, the space travelled over. Harry added, that he had been trying to invent some machine for this purpose on the day he had been in the *dumps* during their journey. He could not then hit upon any contrivance which would answer, though he had watched the wheel so long; but after thinking of it again and again, at different times and in various ways, he had at last made what he hoped would succeed.

When his father saw and had examined the model, Harry pointed out exactly what was his own, and what was borrowed in the invention. Very little of it, he said, was *quite* his own; each part he had taken from different machines which he had seen at different times: the first thought was suggested by a common *way-wiser*, with which long ago he had seen a man measuring the road. "That machine, you know, father, measured by means of a wheel, and made me first think that one of the wheels of a carriage might be made to answer the same purpose. The way of connecting the turns of the wheel with the other parts of my machine, I took from something I saw at the cotton mills; and an arithmetical machine, that I saw at Digby Castle, helped me to the

manner of counting the turns, and showing them in miles and furlongs upon the dial-plate. So you see, father, hardly any of this was my own, except the putting together."

His father highly approved of his integrity, which he valued far above any ingenuity. "But I must observe to you, Harry," said he, "that all invention is, in fact, only putting together in a new manner, or for a new purpose, what we have seen or known before."

As to this little contrivance, his father said that he would have it executed for him in the proper size, and that he would give him an opportunity of putting it to the test of experiment, by which means he might see how far it would succeed, and what were its defects. "There is," he added, "a watchmaker in the village, who can, I think, divide this dial-plate, and cut the teeth in these wheels for us, and a smith who can do the rest of the work.'

Lucy hoped that it would be ready by the first day when Harry was to go out in the carriage, and the surgeon said that might be the following Saturday.

Saturday came, and the carriage at the door; but the odometer, so far from being finished, was scarcely begun. However, this was no disappointment to Harry, whatever it might be to Lucy. On this first day of going out after his long con-

finement, so many pleasures of such different sorts absorbed his mind, that, as he acknowledged afterwards, the odometer would have been too much. The freshness of the air, the sight of the country as they drove along, and all the old objects, now new to him, he enjoyed with the keen relish of restored health and liberty. Other and more exquisitely pleasurable feelings filled his heart: gratitude to Providence, and grateful affection to that dear father, and mother, and sister, whose sympathy, and tenderness, and cheerfulness had in so many ways made him happy. He scarcely spoke during the whole drive; and recollecting this just as they came home, while he pressed his mother's hand, he said he was afraid he had been very disagreeable. "I believe, mother, I have hardly said a word either to you or Lucy."

But his mother well knew the course his feelings had taken, and even Lucy had respected them in silence.

It was, if Lucy counted rightly, nine days beyond the promised Saturday before Harry's odometer was completed. Even when the best workmen are employed, difficulties in making a new contrivance will occur; but in this remote place various mistakes, trying to the patience of young and old, were committed. At last, however, it was completed, and was fastened on the carriage,

and the carriage was driven on a road to a certain distance, the exact measure of which had been previously ascertained. Upon examination it was found to answer as well as could be expected on a first trial. There were some causes of inaccuracy, which Harry perceived and thought he could remedy: it was taken off, and brought into the house; and, while Harry and his father were considering how it might be improved, Lucy was talking in a low voice to her mother. Whatever it was she was saying, Harry's attention was so much distracted by it, that he could not comprehend some very simple suggestion.

"Is it possible that you do not understand me, Harry?" said his father.

"No, sir, not yet," said Harry, blushing piteously; then suddenly he looked back at Lucy, and she stopped short. Her last word was "*patent*."

"Nonsense, nonsense," muttered Harry.

Her father smiled. "Now I perceive," said he, "what confused Harry's understanding so much."

"Father, I assure you," cried Harry, "I never thought of such a thing for myself."

"But why should not he, papa?" said Lucy. "Do not you remember the history of the young gentleman of eighteen, who had a patent for a new invention?"

“But I am not a young gentleman of eighteen,” said Harry, “I am only a boy.”

Notwithstanding Harry's deepening colour and tone of discomfiture, Lucy now went on, because she fancied that her father would agree with her, and that it was only Harry's bashfulness which made him oppose her so bluntly. But her father gravely and decidedly told her that he thought Harry was quite right, and that he was glad that he had good sense enough not to have formed any such scheme for himself. Lucy said no more.

“Harry,” said his father, “a friend of mine, twelve years ago, invented a measuring machine on a new principle, superior to yours, and to any I have seen. He has tried it for four years, applied to the wheel of his gig, and he has sent an account of it to Dr. Brewster's new series of the *Edinburgh Philosophical Journal*.”*

Harry was very curious to see it, and especially desirous to know the new and better principle. His father promised to show him the description of the contrivance as soon as he could get the *Journal*.

“Then yours is now of no use, Harry,” said Lucy, with a sigh. “I suppose you will not do anything more to it.”

But Harry said that he should be ashamed to

* No. v.

leave it till he had made it succeed ; at least till he had tried to mend its faults.

This resolution, and his immediately preparing to carry it into execution, obtained for him from his father a look of affectionate approbation : happy in this, he went off with his odometer to the watchmaker. As soon as he had left the room, Lucy returned to the subject of the patent.

“ Papa, I suppose that the reason why you said it would be foolish to think of a patent for Harry was because you knew of this better machine.”

Her father said that this was not his reason.

“ Then, papa, perhaps there is something about the expense of a patent which I do not understand. But, putting that out of the question, would not you be glad that he had the honour and glory of it ? ”

“ No, I should not,” answered her father ; “ even supposing any honour and glory were to be obtained by it.”

“ Nor I, Lucy,” said her mother ; “ though you look so incredulous.”

Lucy paused again upon this.

“ Then I see how it is,” said she ; “ yet I should never have thought it. You would be afraid that it might make him vain. But I really do not think he is the least inclined to be so.”

“ Well, if he is not,” said her father, “ why

should we try to make him vain? Why put him in danger?"

"I do not think, papa," said Lucy, "that there would be any danger of that sort for Harry."

"My dear, no human creature is altogether exempt from vanity: the most sensible people are most aware of the danger in themselves, and carefully guard against it. But, independently of the risk of making your brother conceited, there are other reasons which would prevent me, as his friend, from desiring that he should be early brought forward into public notice. If my son were really a genius—if, for instance, like Bernini, a famous Italian sculptor, he had at twelve years old produced a work to wonder at, I would not have done what his father did, I would not have set it up in the Vatican to receive the public admiration. The observation of the French wit is generally found to be true—'*C'est un fardeau très pesant qu'un nom trop tôt fameux.*' Can you translate that, and apply it, Lucy?"

"A name too early famous is a heavy burthen," answered Lucy. "You mean, papa, that people might afterwards expect too much from such early fame. But then, if Harry could do more and more, and go beyond what is expected, how glorious that would be!"

"It would; and in some few instances that has been found to be the case. For example, Bernini

exerted himself to support his early fame, and succeeded ; but, in general, boy-wonders sink into insignificant men."

"Without being a wonder, however," said Lucy, "it is surely a good thing that a boy should be thought clever : and I have heard people say that Harry is clever for his age ; so have you, mamma, and you like to hear him praised. Do not you, mamma?"

"I acknowledge it," said her mother. "But this is no proof that it is good for him."

"I know that you and papa must be right," said Lucy ; "but still I should like to understand exactly all the harm it would do him."

"It would probably give him the habit of expecting praise for the slightest exertion," said her father, "and then he would feel unhappy, and unable to exert himself without it. This is one of the first inconveniences usually felt by those who have been early overpraised ; he would afterwards find other bad consequences of more importance. He would no longer be satisfied with the feeling of doing what is useful and good ; he would act, not from the right motive, the desire to do his duty, but merely from the wish to obtain praise. Then he would necessarily become dependent upon the opinions and caprice of others, and might perhaps be led to do what is foolish or wrong, to obtain applause. Even if his good prin-

ciples preserved him from doing wrong, and his good sense from doing what was foolish, still he would lose that strength and vigour of mind which should enable him to labour hard and long, as all must do who wish to attain eminence in any science, or excellence of any kind, moral or intellectual."

DANSEY'S KITE.

SIR RUPERT DIGBY, as it may be remembered, told Harry that a kite had been lately employed for the useful purpose of assisting in cases of shipwreck.

Since they had lived on this coast, Harry had heard of instances of ships driven on the rocks in such situations, that, in a storm, boats could not get out to their assistance; and sometimes the vessels and all on board had perished, actually within sight, and almost within hail of the people on shore, who had no power to help them. In circumstances such as these, a kite that could carry out a line of considerable length, and then drop in the right place, might effect a communication with the shore, and might be the means of saving the lives of the crew.

The idea of this kite had often during Harry's illness flitted before his mind. He longed to know how it was contrived. He had brought home the volume containing an account of that ingenious invention;* but his father had advised him to try

* "Transactions of the Society of Arts," vol. xli. p. 182.

if he could think of any way of effecting the purpose himself before he read the description. His father now told him, that Captain Dansey's kite was not made of paper, but of light canvass, stretched upon two cross sticks; and that, as those materials were to be found in every vessel, it might, in case of necessity, be made in a few minutes. Such a kite, it was said, had carried out, in a strong breeze, a rope of half an inch in circumference, and two-thirds of a mile in length.

"But," continued his father, "you know that the chief peculiarity of these kites is the ingenious apparatus for making them suddenly descend; and it is fair to tell you that this is effected by a messenger, which travels up the string, and detaches it from the belly-band or bridle, though the string itself remains fast to the head of the kite. Now, Harry, an easy but certain method of doing this is what you have to contrive. However inferior your method may be, still it will have been a good exercise for your invention, and on an interesting and useful subject, within your reach."

To assist him a little further, his father added, that the messenger was composed of a hollow cylinder of wood, through which the string passed, and of four cross arms, on which a small sail was stretched. All this being explained, the question recurred to Harry at every spare mo-

ment; and, after devising sundry complicated contrivances, which were one after another rejected, he at last brought one of his projects to a simple form; and immediately set about its execution.

Of the strong wire which had been given to him for his suspension-bridge, he had some left. He bent a bit of this wire into a shape something like that of a pair of sugar-tongs; and, about half an inch from each of the points of these tongs, he again bent the wire inwards to nearly a right angle. These points, however, did not meet, but, when the tongs were slightly compressed, they not only met, but lapped over each other. He then cut a narrow hole or slit in a thin bit of wood, so that, when his tongs were pushed into it, they were squeezed together, and the points lapped over. The elasticity of the wire prevented the piece of wood from slipping, though a slight blow would push it off, and allow the points to open. So far being completed, Harry carried his work to his father, and explained to him his plans.

“The bridle of the kite,” said he, “is to be hooked on the bent points of these tongs; and you see, father, they must hold it fast till the messenger knocks off this piece of wood; the tongs will then open, and the bridle will slip off. To the middle, or handle part of the tongs, the

main string is to be tied ; but I shall also connect it by a short loose piece to the head of the kite, which would otherwise blow away when the bridle slips off the hooks."

This all sounded well, but would the force of the messenger be sufficient to drive the bit of wood off the ends of the tongs? This could be only proved by experiment, and Harry was eager to try it.

His father had the wooden cylinder for the messenger turned for him, on a small scale proportioned to his kite. It was about six inches long, and two inches diameter ; its wooden arms about eight inches in length. The sail was made of a square piece of light linen, the corners of which being stretched out and tied to the arms, the messenger with its sail was complete and ready for action.

Harry's kite was small, but of the same proportions as Captain Dansey's. It was made simply of two laths tied together in the middle, cross-form ; the cross lath being two-thirds of the long one in length, and placed within one-third of its length from the top. A square silk handkerchief formed the covering. He stretched it over the laths, tying one corner at top and one at bottom over their ends, then stretching the two upper sides to the ends of the cross lath, and tying them in the same way with twine, he left

the remaining part of the sides and the corners to hang down as flaps or wings.

The tail was made with coarse broad tape, and small bits of wood, instead of wisps of paper. A coat button was tied to the lower end of the kite, a button-hole being made at one end of the tape, so that the tail could be buttoned on or taken off at pleasure. This was a convenience when it was to be carried out or put away. For entering into these trivial details, the author may be blamed by critics ; but perhaps may be applauded by future kite-makers.

Anxiously was the wind watched every morning, now that the kite was ready for trial. At last a day came, when there was happily wind sufficient, and out sallied Harry, his father, and his kite. It was some time before Harry could get it up. It fluttered with uncertain motion, rising a yard or two ; then sinking, it trailed on the grass. A fresh breeze raised it the whole length of its tail, which, floating obliquely, seemed to struggle and writhe in the air. By degrees it rose higher, flapping its silken wings. Harry held in the string till he felt that the wind had power over the kite. Then he judiciously let out the line more and more, or less and less, as he felt the force slacken, or the gusts increase. Now running with the kite, now stopping—feeling, as it were, with its feelings, humouring its humours,

aiding its weakness, and glorying in its strength. Joyful at last, he saw it clear the trees, rise rapidly in the higher regions of air, and there rest in steady poise.

“It is up!” cried Harry.

“But can we bring it down?” said his father.

Up goes the messenger; the wind carrying it swiftly along the line, it appeared to fly gladly on its errand.

“But will it, can it, do its business?”

For a few seconds this doubt kept Harry and Harry's father breathless. The little kite reached and darted upon the larger. They struggled, or seemed to struggle for an instant, like two birds in unequal contest. The little one gained the victory.

“It's done! it's done!” cried Harry, “the kite is falling!”

And gently and safely both came down together. Harry ran to the spot where they fell, to separate them, and to see whether they had done any mischief to each other.

“All safe! Not the least damage done!” cried Harry.

“Nothing could succeed better. I give you joy, Harry,” said his father.

But there could be no complete joy without Lucy. Harry said he would run home to tell her and his mother all about it, and to show them his

good little messenger. He had kept the contrivance by which the kite was to be brought down a profound secret even from Lucy, having determined to try it the first time with no one by but his father. And, if it should answer, then he hoped to delight Lucy doubly with the pleasure of the success and the surprise.

MOTHER-OF-PEARL.

WHILE Harry had been flying his new kite, Lucy's mind had been occupied with far other thoughts. She could not guess what he and her father were about ; for Harry had taken out his kite by a back way, and then returning to the breakfast room, had said in a half whisper, " Can you come out with me now, father ?"

" Yes, Harry, I am at your service."

" So am I," thought Lucy ; " yet he is going without me."

There had been, for some days past, conferences and consultations between Harry and his father, as Lucy had remarked, to which she was not summoned : her curiosity and some other uneasy feelings were excited, which she could hardly suppress, and yet did not like to express. She had been so much accustomed, especially of late, to know and to be interested in all that occupied Harry, that she felt a sort of disappointment when she was excluded from these secret councils. Her curiosity was now raised to an almost insupportable height, by the signal, the half-whisper, the

abrupt exit, and secret expedition of this morning. They had thrown open one of the breakfast room windows and jumped out. Her eyes followed them, as they walked briskly away. She then took up a book to read, but soon laid it down, and went to her drawing-table; then she opened her work-box, and at last sat down near her mother. After an unusual silence, Lucy suddenly asked her mother to guess what she had been thinking of all this time.

“It will be easier for you to tell me, my dear Lucy,” said her mother, smiling.

“I will, mamma,” said Lucy. “And yet I do not know why, but I am a little—however, I will. Then, mamma, you must know, that all this time I have been thinking, or rather trying to hinder myself from thinking, of something which I know is not quite right; but still the thoughts come, and I cannot help saying to myself, I wonder why Harry did not wish me to go with him. I know this is all foolish curiosity, mamma—you are going to tell me so.”

“I was going to remind you, my dear, of the iron door,” said her mother.

“Ah, yes, to be sure; but it was easy to put that out of my head. Besides, I did not care much about the iron door, but I do care about Harry; and is it not natural to be anxious about what concerns him, mamma?”

“ But if he wishes you not to know it—”

“ I know what you are going to say,” interrupted Lucy, “ that it is not right for me to try to discover it ; therefore I really want to put it out of my head. Pray tell me, mamma, how to do that.”

“ Turn your thoughts to some other subject,” said her mother.

“ Indeed, mamma, I have been trying to do so,” said Lucy. “ I took up a book, but I read the same sentence over and over again. Every instant I found myself looking out of the window at papa and Harry, walking down the avenue. The same ideas would come back : ‘ what are they talking about ? ’ ‘ what are they going to do ? ’ I cannot think of anything else.”

“ If you cannot think, *do* something, Lucy,” said her mother. “ Suppose you were to cut open the leaves of that Review for me. Take this new mother-of-pearl folding knife, which your father gave me this morning. Is it not pretty ? ”

“ Very pretty,” said Lucy, looking carelessly at it.

“ Do you see the colours, which change continually as you move it ? ” said her mother.

“ They are beautiful ! ” said Lucy ; “ but I have often observed such colours in mother-of-pearl.”

“ But did you ever consider what produces these colours ? ” said her mother.

“The reflection of light from the polished surface of the mother-of-pearl, I suppose, mamma,” said Lucy.

“Then why do you not see the same colours from the polished handle of this ivory knife?” said her mother, placing the two before her in the same light.

Lucy now began to examine the mother-of-pearl more attentively. She was struck with the succession of beautiful tints that were developed by the least motion, and asked her mother if anything was known about the cause of these changing colours.

“Yes, my dear,” said her mother. “It has been lately discovered that the cause of these colours depends upon a singular peculiarity in the structure of mother-of-pearl. On its surface, which to your eye and touch appears so finely polished, there are innumerable scratches, or indentures, in some places as many as two or three thousand in the space of an inch, and lying parallel to each other, whether in straight lines, in waves, or in circles.”

“Three or four thousand in an inch, mamma! but I cannot see one of all these thousands: I cannot feel even the slightest roughness!”

“But with a microscope,” said her mother, “and sometimes even with your pocket magnifying-glass, you would see this exquisitely smooth

surface full of the little lines or *grooves* that I have described. Some people compare them to the delicate texture of the skin at the top of an infant's finger."

Lucy, continuing to rub her finger over the polished surface, said, "But, mamma, what can these scratches have to do with the colours? I have a knife with scratches all over its handle. Look at it, mamma: you see it has no colours."

"But the handle of your knife, Lucy, is not of mother-of-pearl."

"No, mamma; but if scratches are the cause of the colours in the one case, why not in the other?"

"There is a great difference, Lucy: the indentures in mother-of-pearl regularly follow each other in all their windings; the accidental scratches on the ivory cross each other at random. The rays of light are reflected by the edges of the grooves; and the continual change of colour arises from their continual bendings and turnings."

"Then, mamma," said Lucy, "by polishing the mother-of-pearl still more, we should get rid, I suppose, of all these little grooves, and there would be no more colours."

"Polish as much, and grind it down as much as you will," said her mother, "as long as any of the mother-of-pearl remains, you will still find the grooves. The same structure is not only at the surface, but throughout the whole substance."

“How extraordinary!” said Lucy.

“I have a still more extraordinary fact to tell you, my dear,” said her mother.

“Oh! what, mamma?”

“That the colours, which you see on the surface of the mother-of-pearl, can be communicated, by pressure, to sealing-wax and several other substances.”

“Is it possible, mamma?” cried Lucy.
“Well, since nothing should be taken for granted, will you be so very good as to tell me how all that is proved?”

Her mother told her, that it was Dr. Brewster who first discovered the cause of the colours seen in mother-of-pearl; and that afterwards, having stuck a piece of it on a cement made of rosin and bees'-wax, he observed that the cement, when separated, had actually acquired the property of producing the same colours.

“Was not he excessively surprised?” said Lucy.

“He was surprised; and several gentlemen, who saw the experiment, thought that this unexpected phenomenon was caused by a thin film of the mother-of-pearl, which might have scaled off, and stuck to the cement. A very simple experiment, however, convinced them that this conjecture was a mistake. He made a fresh impression of the mother-of-pearl on black sealing-

wax, and then plunged it into an acid,* which does not affect wax, but which is known to destroy the substance of which mother-of-pearl is chiefly composed.† If there had been left on the wax the slightest film of mother-of-pearl, it must have been dissolved ; but the acid had no effect, and the prismatic colours of the impression remained undisturbed. This, you see, was a complete proof that there was no film of mother-of-pearl left on the seal."

" It does satisfactorily prove indeed, mamma," said Lucy, " that it was the grooves, as Dr. Brewster thought, which caused the colours both in the mother-of-pearl and in the impression on the wax."

" Yes," said her mother ; " and he tried similar experiments on other substances, such as tin-foil and lead, and all showed the prismatic colours in the same manner, and from the same cause ; so that the fact, and its cause, are now quite ascertained ; and you find, Lucy, that you may believe them without taking anything for granted."

Lucy was quite satisfied, and rejoiced at understanding how the proof was complete. " This is another instance, mamma, of the advantage of trying to find out the causes of the common things we see every day. How much Dr. Brewster's accidental observation led to !"

Nitric acid.

† Carbonate of lime.

“ And to more than you yet know,” said her mother. “ I will read to you part of a letter your father received this morning from him :—

“ There is also a very extraordinary fact respecting the communicable colours in mother-of-pearl, which deserves to be mentioned. One set of these colours is produced by the right side of the grooves, and another set by the left side, and *both* of them are distinctly seen when the mother-of-pearl is *polished* ; but, when the polish is removed by rough grinding, one of the sets *invariably disappears*. The rough grinding, therefore, destroys the effect of one side of the grooves, without affecting the other.”

Lucy's mother then told her, that, in consequence of Dr. Brewster's discovery of the cause of the colours in mother-of-pearl, another ingenious gentleman* produced the same appearance on glass, and on different metals, by simply cutting fine parallel lines on their surface. “ The lines are so fine,” she added, “ that without a microscope they are scarcely discernible, and the glass and the metal appear to retain their polish ; yet they and the colours also may be communicated by an impression like those from the mother-of-pearl to the wax.”

Her mother then showed her a gilt button, the lines on which had been struck by a steel *die*, and a bit of glass, on which they had been cut by a diamond, and from both she saw the prismatic colours reflected as beautifully as from mother-of-pearl.

* Mr. Barton.

“ But, Harry !” exclaimed Lucy, “ all this time I have forgotten about Harry : how very nicely you turned my thoughts for me ; and quite put out of my head what I could not drive away. Mamma, this is all your doing : I wish it had been my own.”

“ The best part of it is yours, my dear child,” said her mother, “ the wish to do right. The asking for advice and assistance was your own.”

“ I wish I could manage my thoughts for myself in the same way,” said Lucy. “ That curious discovery entertained me so much, that I forgot everything else. Mamma, this is another advantage of having a taste for things of this sort ; they help us to turn the mind from what you call foolish curiosity.”

“ Yes, Lucy, they will often assist you in managing your own thoughts and your own mind,” said her mother. “ This is one of the great benefits which women derive from cultivating their understandings, and the best use they can make of a taste for literature and science.”

“ Mamma,” resumed Lucy, after some pause, “ I am very glad that you let me *go on* with Harry. I am sure it has been the cause of great pleasure to me. Even on the journey, it was so pleasant to be interested in the same things. But above all, during Harry’s illness, it was the greatest happiness to feel that he liked to have me with him always, reading and talking to him, and

being interested in the sorts of things which he liked best. Mamma, I hope you do not think it has done me any harm ; I hope you do not think that I have grown careless about other things."

"Not in the least, my dear," said her mother ; "on the contrary, I perceive that you have become more attentive to all which it is necessary for you to learn."

"One other question, mamma, and I shall be quite happy if you can answer it as I wish. I hope, mamma, that you do not think that I have grown conceited."

"No, Lucy," said her mother ; "I think it will be with you as I have observed it has been with others who are properly instructed—that the more they know, the less danger there is of their growing vain. They find out how much more there is to be learned, even from the most common objects by which they are surrounded."

"Yes, mamma," said Lucy ; "and I begin to feel the truth of what you have often said to me, that the more we learn of what are called the works of nature, and the wonderful inside of our own minds, the better we must become, and the more pious. I am not sure whether *pious* is the right word, or *religious* ; but you know what I mean."

"I do, my dear," said her mother ; "and, as to the words, it is of little consequence what words you use to express this sentiment, if you feel it, as I hope and believe you do, sincerely and firmly."

KITE AND MESSENGER.

“ HERE he comes ! Oh ! mamma, here is Harry and his kite,” cried Lucy, running to the window. With a face radiant with joy, he came bearing his kite in triumph. High she threw up the sash, and he sprang in, joy adding to his natural elasticity.

“ Lucy ! my dear Lucy ! It does ! It will do,” cried he. “ I would not tell you till I was sure it would succeed. Oh, mother ! it does better than even my father expected. But come out, Lucy, come out, and see it. We will put it up again for you, for there is no joy without you and my mother. Let me tell you about my messenger.”

Then eagerly he began to explain his kite and his messenger. But now, when Lucy saw Harry’s kindness, it struck her how unjust she had been : she was ashamed of her past feelings, and looked at her mother with a consciousness, and a change of countenance, which Harry perceived. He became confused, though in the middle of a panegyric on his messenger, and after making some attempts to piece his story with—“ and so”—

“and so,” he stopped, and putting into her hand a knot in the string, which he had been endeavouring to disentangle—

“Untie this for me, will you, my dear?” said he. His eye added, “What is the matter?”

“Nothing—nothing worth telling you, I mean,” answered Lucy. “It was only that I was very, very unjust, and that I am exceedingly ashamed.”

“That you were a little foolish, my dear, I will not deny,” said her mother; “but you need not be so exceedingly ashamed, because you did your best to conquer your foolish feelings: this is all that the best of us can do.”

Lucy told her brother all that had passed in her mind. He regretted that she had been vexed; but was glad, he said, to know how it was, that he might avoid doing the same thing again; and she assured him that it was all her own folly, and that she hoped never again to be so weak.

“There is your knot untied for you, brother,” she added, returning the disentangled string, “and now all’s right again.”

“Thank you; all is right,” repeated Harry.

And all will be right, and will continue so, between friends, who, in this manner, speak openly to each other of those little feelings, of which, perhaps, they are at the moment ashamed.

This affair being cleared out of Lucy’s head, there was some chance of her understanding

Harry's contrivance, and she and her mother went out, and saw another experiment of the kite, which succeeded even better than the first. The wind blew stronger ; and with bolder wing, as if better knowing his business, the messenger darted up to the very heart of the kite, and at one stroke accomplished its purpose. Lucy rejoiced in the messenger's happy performance of his mission, and looked forward with still greater pleasure to the idea of seeing the kite carry out a line from a boat to the shore. She asked her father when the experiment might be tried ; and Harry observed, that as Dame Peyton's sailor-son had come home, and was permitted the use of Sir Rupert Digby's boat, they could have his assistance. All the circumstances of a pretty little shipwreck were quickly arranged and rehearsed in Lucy's imagination, with the different parts assigned which each were to act in saving the stranded vessel. Harry's mind, in the mean time, went to work at calculating the proper size for a new kite, which would carry out a serviceable rope. But his mother put an end to any further operations by reminding Harry, that, as he was now perfectly recovered, they were to leave Rupert Cottage immediately ; and, in these circumstances, the making a kite of ten feet long would not be very convenient.

Lucy thought, that, as it was only for an experiment, it might be as well tried with the little kite. "All we want, you know, Harry, is to be certain that you can launch the kite from the boat: we on shore can make a signal when it is right over our heads, and then off you would send your good little messenger, and everybody would see how well it did its business."

A circumstance, which they had left out of their calculations, but which was absolutely essential to the experiment, settled the business. During the few remaining days of their stay, the wind never blew towards the shore, or with force enough to carry up a kite. The weathercock was every morning watched in vain; and frequently did Harry and Lucy walk along the beach, in hopes of seeing a fine sea-breeze curling the water. In one of these walks a boat, that was rowing along the shore, stopped abreast of Harry and Lucy, and a gentleman in it, whom Harry knew, asked him if he thought his father would be so good as to lend him his small telescope. Harry ran to ask for it; and his father, with the telescope in his hand, walked with him to the sea-side, and permitted him to accompany the gentleman, who promised to set him ashore as he returned. When he came back, Harry described to Lucy all he had seen; and what was on the present occasion more

interesting to her, repeated all he had heard of some people, who were lately saved from shipwreck by the use of life-boats.

“A *life-boat*, Lucy,” said Harry, “is a kind of boat which cannot sink. There are several kinds. That which was described to me was lined with large copper tubes, empty and air-tight; so that in a storm, if it should fill with water, the air in the tubes would still buoy it up. With such a boat, people can go out to a ship in distress, when none other could possibly venture to sea.”

The gentleman, pleased with Harry's zeal and intelligence, had talked to him much on that subject, and had related to him several anecdotes of a benevolent old quaker, who was in the habit of going to the sea-coast every year for the recovery of his health. That part of the shore was very dangerous; and, hearing of frequent shipwrecks, he had a life-boat built, which cost him three hundred pounds, and made a present of it to the inhabitants. The generous old quaker constantly rewarded those who were most adventurous in going out in it. He was old, infirm, and very ill when the gentleman last saw him, evidently dying, but his mind was as much alive, and his feelings were as warm, as if he had been eighteen instead of eighty.

At that last interview the life-boat was talked of; then his enthusiasm broke out: he seemed to

forget his years and infirmities ; and, conquering bodily pain, he started from his seat, and took the gentlemen to his boat-house. The boat was mounted upon a carriage with wheels, that it might be ready for rolling down to the shore. They could only get up the side by a ladder, but the old man climbed up without assistance, jumped into the middle of the boat, showed every part, and appeared to feel a generous triumph in the lives it had already saved, and those which he hoped it would yet save. This was the last time he ever saw him ; he died soon afterwards ! All who knew him—the whole country—flocked to his funeral : and it was very singular, the gentleman added, that, while they were attending it, the most violent storm came on that had been known for many years ; a vessel was cast upon the rocks, and the people returned just in time to launch the life-boat, and to rescue three persons who would otherwise have perished.

The name of this humane and truly charitable man was Backhouse, a name that better deserves to be remembered than that of many celebrated heroes. Warriors are often famed only for the number of lives they have destroyed, but this excellent quaker ought to be remembered for the number of lives he has saved.

WALK TO DIGBY CASTLE.

A DAY or two before they left Rupert Cottage to return home, Harry went the first long walk he had been allowed to take since his release from confinement. It was to Digby Castle, by the mountain-path. The day was bright, and everything was fresh and pleasant. The path, in many places, was quite as narrow as those could desire who love the narrow path of danger. There was full opportunity, also, for scrambling up and down the rocks, so as to try, to his heart's content, the newly recovered use of his limbs. But at last the mountain-path ended, and they came upon the road.

Here Harry and Lucy walked slowly and soberly, and recalled to each other's memories the first time of their coming this road, the happy days they had spent at Digby Castle, and all Sir Rupert's and Lady Digby's kindness to them. Then they talked over what had passed at Rupert Cottage, in the *olden* times of the canal, and the lock, and the roof; and even on the misfortunes of his broken bridges Harry could now moralize

with composure. He had, besides, the consolation of reflecting that the failure in his bridges had led to his learning mathematics.

When once their recollections began, they went on, or rather went backwards, through the whole time since they had left home. They travelled their journey over again, and tried how much they could remember of what they had seen or heard. Their recollections were very different, but between them much was made out, the one supplying what the other forgot. Lucy recalled a variety of little entertaining circumstances, which had escaped Harry's memory, and she benefited still more by his clear remembrance of the solid and useful. She was anxious to show Harry that the pains he had taken in explaining some things to her had not been thrown away; and her father, who now joined in their conversation, observed that she did her brother credit.

"Then, father," said Harry, "it is all owing to those first experiments you took so much pains in showing us, when we were quite children. For instance, you made me then clearly understand the principle of the barometer; and that one thing clear and fixed in my mind was, I have always felt, the greatest help to me. There was something I was sure of—something I could always go back to."

Lucy said she had felt the same; and that

unless she had understood about the barometer, and the vacuum, and the pressure of the air, Harry could never have got her on, through the pumps, to the steam-engine. She lamented, however, not remembering more of the variety of curious things which she had seen on her journey.

“Oh, mamma,” she continued, “I wish I had kept a journal! then I should have had them all safe.”

“Your having them all safe on paper,” said her mother, “would be useful, because you could refresh your memory from time to time; but it would be still better if you had them all in your head, so that you could recollect them at any moment.”

“Certainly, mamma; but do you not think that writing down things would fix them better in my memory?”

“I am afraid not, my dear,” said her mother. “I have often found that I completely forget those things which I had written down.”

“But why is that, mamma?” said Lucy.

“Perhaps because we ease our conscience of them,” said her mother, “and never make any effort to recollect them. There is an English saying, ‘What is written remains.’ It may remain on the paper, but not the better on the memory. The Italian proverb is probably more

correct, ‘L’ho dimenticato perche l’ho scritto.’ I have forgotten it, because I have written it.”

“Perhaps,” said her father, “another reason is, that we are apt to write *mechanically*, that is, without thought; and what we do without thought we seldom remember.”

“But, papa,” said Lucy, “if I had kept a journal, I must have tried to recollect the things at the time I was to write their description in my journal; though, after all, I dare say that I should have trusted to Harry’s memory. He used to ask me every evening if I remembered such and such a machine that we had seen in the day; and he reminded me so well of all the parts, that I scarcely endeavoured to recollect them for myself.”

“You see,” said her mother, “that you depended on your brother, and did not exert your own memory. Though yours is, perhaps, naturally better, his has served him more usefully.”

“Yes, mamma,” said Lucy; “but I really believe that talking of what we have seen or heard makes one remember better than even writing down. The pleasure of talking is a great help,” added she, laughing.

“I think there is also a pleasure in listening,” said Harry.

“Certainly,” said Lucy, “when one is listening

to what is interesting or new ; but otherwise I hear, as it were, without listening, and then the words go in at one ear and out of the other—I have only the sound left.”

“ Yes, Lucy,” said her father, “ you hear *mechanically*, without attending, in the same way as you would copy with a machine. Your mind is then merely passive ; whereas, the pleasure of any successful exertion, as well as the labour of thinking, have the effect of fixing ideas or impressions in our minds. Pain or pleasure of any kind, joined or associated with our thoughts, secure them in the memory, and assist us in recollecting them. If you reflect on your own mind, I think you will find that to be the case.”

Harry drew closer to his father. This was a subject peculiarly interesting to him, as he had lately been so intent upon finding out what he called the workings of his own mind. His father stopped short, and good-humouredly remarked, that, though Lucy knew much less than Harry did, yet she had told them much more of what she had seen and heard.

Harry was silent ; and Lucy, feeling for his condition, filled up the interval with talking, to give him time ; and she finished with an allusion which relieved his embarrassment, and made even his gravity smile. “ Papa, Harry and I are like two bottles—one full, and the other with very

little in it : shake the full bottle, and you hear no sound ; but shake the half empty one, and you hear it rattle finely."

By this time they were within sight of the castle, and Harry, heartily glad to be excused from further explanation, ran forward to open the gates for his mother.

Their good friend, the housekeeper, had from her turret window descried their approach, even from the farthest end of the avenue, and she had prepared for them a luncheon, such as might have tempted the most determined anti-luncheonist to break his resolution,—the first strawberries of the season, from the forcing-house, which the gardener was proud to set before his master's friends. Since, as he said, his master and mistress were not at home, this was the best could become of them. All were eager to offer Harry the best of what the castle could afford, for the history of his accident was well known. The father of the child he had saved waited upon them, and lingered, and looked often and long before he could feel convinced that Master Harry was quite himself again—as stout in his limbs, and as good as ever. His last excuse for coming into the room was to bring a message from the steward, about a box which had come from Sir Rupert, with some lamps, which he could not rightly understand, and begged to show them to

Harry's father. They were found to be miners' safety-lamps, which Sir Rupert, before he left England, had bespoken, and had given orders should be sent to an estate of his at some distance, where there were coal mines. By some mistake this box had been sent to Digby Castle. It was a mistake by which Harry profited. Once he had had a glimpse of one of these lamps in the mine, which he had seen on the journey, but his father had not then explained it to him. The ready footman carried one into the library, where Harry might examine it at his leisure. His mother found for him the description and explanation of the lamp in the "Philosophical Transactions," which he immediately read, with the lamp before him. He was struck with the simplicity of this admirable invention, by which the lives of thousands have been saved from the destructive explosions of the *fire-damp* in mines. But what particularly delighted Harry was, the account given by the inventor of the way in which he was led, step by step, to the discovery on which the excellence of this really wonderful lamp depends. First, he discovered that flame will not pass through long tubes of less than a certain diameter; then that tubes of metal conduct away heat better than those of glass, which determined him to use metal. Then experiment proved to him that it was the diameter, and not the length of the tubes,

that was essential to his purpose; in consequence of which he shortened and shortened them, till, to his great satisfaction, he found that tubes might be dispensed with entirely; and that a plate of metal, perforated with small holes, or even wire gauze, with interstices of the same diameter as the tubes, would answer equally well.

As Harry's father observed to him, there cannot be a finer example of the rise, progress, and perfecting of a useful philosophical invention. In the first place, no part of it was owing to accident, to any lucky hit, or even to any casual observation, but all was the consequence of a settled good purpose working in the mind of a man of science, genius, knowledge, and humane views. He had heard of the destruction caused by fire-damps, and determined to try what could be done to avoid or prevent the danger. His first step was to go down into the mines, and examine into the nature of these noxious vapours. His previous knowledge of chemistry was here essential to his success, and each step was forwarded by his philosophic habits in trying experiments; by his observing and reasoning on all appearances before him, and employing alternately theory and experiment; that is to say, first forming a conjecture how the thing might be done, and then impartially trying whether his suppositions were right or wrong.

“How much the public,” his father added, “and how much young people of rising genius, are obliged to inventors, who both *can* and *will* thus lay open their minds! Many ingenious persons seem not to have had the power of describing their own inventions; for instance, Vaucanson, a celebrated French mechanic, who never could describe his own machines. Others, like Hooke (whose life, Harry, you read lately), have been so suspicious of their rivals, that during their whole lives they would not open above half their minds, and at their death left their contrivances locked up in enigmatical language. They seem to have taken pains to obliterate all traces of the road their minds took, lest rivals should follow in their tracks. But, my dear son, observe, that really great men are superior to such mean jealousy. You feel how much Sir Humphry Davy has in this instance, by his openness, increased our admiration and gratitude.”

CONCLUSION.



WHEN they were setting out on their walk back to Rupert Cottage, Harry said to Lucy—

“Let me go on before with my father, I want to talk to him alone.”

“Very well,” said Lucy; “this time I shall have no foolish curiosity.”

“You need not,” said Harry. “It is no secret. If you please, I will tell you my reason for wishing that you should not be by.”

“No, pray do not, Harry, I assure you I am not curious *now*, so go on with papa; my mother is going to make a sketch of Digby Castle from this place; I have paper and pencil, and I will also try what I can do. Will you wait for us at the suspension bridge?”

“Thank you, my dear good Lucy,” said Harry, taking her pencil from her hand, and cutting it to a fine point; “but you must let me tell you my reason; it is only that what I want to say to papa is all about myself; and you know that when one has to talk of oneself, and one’s own little feelings

and schemes, one can speak much more freely when nobody else is present."

The fact was, that the sight of the miner's lamp, and the account of that discovery, and the admiration which his father had expressed at the idea that thousands of lives would be saved by this one invention, had altogether worked up Harry's enthusiasm. Thoughts, which had been lying quietly at the bottom of his mind, were now set in motion, and thrown to the surface. His father knew him better than anybody else, his father was therefore the confidant he preferred to all others. Happy the son who in like circumstances feels that his father is his best friend!

"Father," said Harry, "a few words you said to me, long ago, made a great impression on me. I have often thought of them since, and of something of the same sort which Sir Rupert said to me, at the time of the balloon, when we were talking of great inventions. Do you recollect, father?"

His father recollected, and spared him the difficulty of repeating the words. Sir Rupert had prophesied that, if Harry's application and diligence continued, he would hereafter distinguish himself as a man of science.

"Then I must tell you, father," continued Harry, "that I have long had, deep down in my mind, deeper, I believe, than anybody sees but you, a great ambition to make, some time or other

in my life, some great discovery or invention. I have been long thinking of this, and considering how other people have succeeded. When I was confined to the sofa, I thought of it more and more; and particularly how I could manage my own mind so as to make it do what I want. In reading the accounts of the childhood of great or scientific men, I have tried to find out what they did and said, that I might compare my thoughts and ways of going on with theirs: but enough is never told of these things. On the other hand, father, when one thinks of the millions of people that exist, and of the few that distinguish themselves, it does appear very presumptuous to hope that I should succeed. How many people, when young, must have had the same feelings that I have now, and the same ambition; yet they have failed. But why have they failed? this is what I want to ask you, father. Another thing puzzles me," continued Harry, who could now speak fluently, his thoughts flowing on, and forcing themselves into words. "During our journey, when we were at the glass-house, and when we read all about the discovery of printing; and since that time, when Sir Rupert Digby was giving us the history of electricity, and of the invention of balloons; and more lately still, in those books which I have been reading during my illness, I have continually observed, with surprise,

how long it was before even the most ingenious men hit upon those discoveries and inventions, which, now that we know them, appear to us so easy and simple: and I have said to myself, if these things were so difficult to them, how little chance have I! Yet, father, I think people have a better chance now than in former times. More discoveries have been made in our days than in the time of the ancients."

"Yes," said his father, "because knowledge is more generally diffused. More people try experiments; and all are convinced that this is the best method of arriving at truth, or of making discoveries."

"Still, father, I want to find out why, now that this is known, so few among the numbers who try succeed. I wish I could find this out, that I might learn how to secure the best means for myself."

"Some people," said his father, "are inaccurate in their mode of trying experiments, or rash in drawing their conclusions; or they may have some prejudice or favourite theory, which prevents their seeing what is before their eyes. Their failure arises from taking a wrong view of the object, or a wrong road to it."

Harry asked his father if he knew of any book that gives directions or advice how to get forward in science, or that points out the best ways

of trying experiments. "I looked over much of that book of Locke's," said Harry, "to try if I could find anything of this sort, but I could not. Is there any such helping book?"

His father mentioned Bacon "On the Advancement of Learning;" Hooke "On the means of improving Natural Philosophy;" Playfair's "History of the Progress of Physical Science;" Herschel's "Discourse on the Study of Natural Philosophy;" and some others.

"Then as soon as we get home and are settled," said Harry, "I will begin and read some of these—would you advise it, father?"

"I have such confidence in your good sense and resolution, Harry," said his father, "that I feel no apprehension of discouraging your laudable ambition by answering—No; I would not advise you to read any of those books *yet*. They would, perhaps, prevent you from working out your own observations, and from reflecting impartially, as you have begun to do, upon your own mind. I advise you then, my dear son, to persevere steadily and regularly in your present course. Never let any one day pass without advancing some step, without acquiring some fresh knowledge. Exercise your faculties, your memory, your reasoning power, your invention, no matter on what, so that you exercise them. They will strengthen, and we can afterwards turn them and your habits of appli-

cation to whatever may be necessary for your progress in science and virtue, and for your happiness."

"My happiness!" cried Harry, "the greatest possible happiness I can conceive in this world next to doing my duty, would be to make some grand invention, some noble discovery."

To this he recurred; this was the chorus of all his thoughts. It was said with such enthusiasm as strongly to excite the sympathy of his father, who paused for some moments before he again spoke.

"I must not be misled by my hopes, or by yours, Harry," said he, "lest I should prepare for you bitter disappointment in future. Whether you may ever distinguish yourself or not, will depend probably on circumstances over which neither you nor I may have any control. But, whether you do or do not succeed in the object of your ambition, you may certainly, my dear boy, by cultivating your taste for science, secure a large portion of happiness. You may become such a man as your friend Sir Rupert Digby. You see how useful, how respectable, how happy he is. You see that it is his taste for science, his indefatigable pursuit of knowledge, and his constant exertions to be of use to others, which constitute his happiness—a species of happiness that is independent of all celebrity, and of all human applause. You have seen on what it depends—

“ Friendship, books,
Ease and alternate labour, useful knowledge,
Progressive virtue, and approving Heaven.”

Harry stopped, and looked back for Lucy, sorry that she had not heard these lines. She and his mother joined them soon afterwards, just in time to hear the words with which his father concluded the conversation.

“ I consider you, my dear son, as no longer a child, and I securely trust to your own efforts for the continuance of your own education. A celebrated person has observed, that every man has two educations—one, which is given to him by his parents or tutors, while he is a child; the other, which he gives to himself when he becomes a man. This latter is of the greatest consequence of the two, and this, with every wise and good man, should go on to the latest period of his life.”

HERE ends all of the history of Harry and Lucy that is to be published.

The reader may, perhaps, feel relieved by these words from certain fears, which may have arisen in his mind, that the said history might extend to a thousand and one volumes.

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